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NATIONAL SCANNING REPORT

CITIZEN'S GUIDE TO

SCANNING

by
Laura E. Quarantiello

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by
Laura E. Quarantiello

TIARE PUBLICATIONS

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FOREWARD

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Many of my friends fail to understand why I carry my handheld scanner almost everywhere with me: in the car, at the airport, the train station, the mall, the baseball game, the amusement park. They don't realize that half of the action taking place around us isn't what we can see with our eyes, but what we can hear with our ears over the airwaves.

A traffic accident isn't just two vehicles in the intersection to me. It is police, fire, rescue, ambulance and news media communications coming active with information all across the bands. Equipped with a scanner I hear the entire story.

A trip to the zoo isn't just a chance to snap a few pictures of exotic animals, eat some popcorn and return home. It is security helping lost children locate parents, first aid assisting a fall victim, park rangers chasing an elusive panther somewhere in the far reaches of the park-out of view and out of mind of those without a scanner.

The President's visit isn't just a two minute news segment on TV, it is a chance to tune in live telephone calls from Air Force One, hear Secret Service agents protecting the VIP's and news agencies scrambling for a good camera location.

The communications of almost every agency that uses a two-way radio eventually falls prey to my always listening ears. It is a challenge, a job, a hobby and a bit of an obsession to track down elusive transmissions all across the scanner bands. It is an active pursuit, often taking me on trips with a scanner in one hand and a frequency counter in the other, hunting....always hunting.

Scanner listening encompasses much more than most folks believe. The goal of this book is to show you some of what's out there on the scanner bands. Hopefully, after reading through this, you will come away with the itch to turn on your scanner and explore what it can do for you. You might become more apt to search the bands, instead of sitting back and listening to known frequencies. You will begin to notice radios and antennas around your town. You will begin to wonder...what's that antenna for? What frequency is that fellow transmitting on? What's this channel used for?

Your scanner is a wonderful communications tool that can take you around your city, across your state, to another country, where voices from the speaker will enchant you and make you want to hear more.

This is an active book, meaning that as you read, I encourage you to punch in the frequencies and ranges mentioned. Try them out! All it takes is the turn of a switch, no other experience needed.

Welcome to the world of scanning! If anything I have talked about is unclear, confusing or in error, or if you'd just like to comment on what you have read, I welcome your letters: write to me in care of the publisher.

My thanks go out to the usual people who have put up with my hobby, and to National Scanning Report's Larry Miller and Tiare Publication's Gerry Dexter for their help and support in bringing this book to print.

- Laura Quarantiello

SCANNER BASICS

♦

WHAT IS A SCANNER?

Webster's Dictionary contains a reference to the word "scanning" which closely represents what a scanner radio actually does: "Scanning: to examine stored material for a purpose; to examine channels for input/output activity."

A scanner is designed to search repeatedly through frequencies stored in memory channels, stopping on active channels and resuming the search when the transmissions have ended. Its sole purpose is to look for communications activity. It will search repeatedly and ceaselessly across hundreds, often thousands of entered frequencies, sniffing the ether for sound waves and converting those waves into speech audible to the human ear.

Because of its ability to process — to scan — across frequencies at high speed, moving instantly from one to another until transmissions are heard, a scanner is a communications monitor's best friend. Today's modern scanners are used by both hobbyists and professionals alike. They adorn the consoles of police and fire dispatchers, television and radio news reporters, trucking, taxi and railroad companies, military, and even Coast Guard search and rescue facilities.

The scanner radio is a link to the electronic conversations floating about our heads every minute of every day.

THE RADIO SPECTRUM

Most people that have used an AM radio have never questioned where the numbers on the analog dial came from. Did someone randomly decide on a slow day that the AM broadcast band would begin at 540 kiloHertz and end at 1600 kiloHertz? And what about 530 kiloHertz and 1650 kiloHertz...do they exist?

They certainly do! The AM band is but a small part of the total radio spectrum which begins around .050 MegaHertz and reaches beyond 20,000 MegaHertz.

Radio Bands

Radio frequencies are grouped together into bands. 540 kHz to 1600 kHz is generally known as the AM band. 88 MHz to 108 MHz is called the FM band. The radio spectrum accommodates many such bands devoted to a specific service, just as the AM and FM bands are to commercial broadcasting. Beyond 1600 kiloHertz are the shortwave bands used by international broadcasters, ships, aircraft, government and the military.

If you were to tune your FM band radio down below 88 MegaHertz or above 108 MegaHertz, you would find the realm of the scanner:

30.000 - 50.000	VHF Very High Frequency low band
88.000 - 108.000	FM Broadcast Band
138.000 - 174.000	VHF Very High Frequency high band
406.000 - 470.000	UHF Ultra High Frequency band
806.000 - 960.000	800 MHz band

Within these bands is some of the most thrilling listening around: police, fire, emergency medical, railroads, ships, aircraft, federal government, military — any service that uses two-way radio can be found somewhere within the scanner bands.

WHERE TO LOOK FOR WHAT: A BAND PLAN GUIDE

Ask a seasoned scanner monitor where to find police communications and chances are he or she will rattle off three or four frequency ranges in the time it take to draw breath. The basic skill - and I would wager the only *real* skill needed in operating a scanner - is knowing where to look for the action. It is this knack of knowing who transmits where that separates the professionals from the amateurs. It separates those who heard all the excitement as it happened from those who watched the incident on an edited newscast hours after the fact.

The following band plan guide should be copied and placed next to your receiver. It is the only information (besides your scanner's operating handbook) needed to get started in hearing action on your scanner.

30 - 50 MHz	Low band government and civilian
50 - 54 MHz	6 meter Amateur Radio band
54 - 72 MHz	Television channels 2-4 audio
72 - 76 MHz	Repeater links and tone paging
76 - 78 MHz	Television channels 5-6 audio
88 - 108 MHz	FM Broadcast band
108 - 137 MHz	VHF Aircraft band
137 - 138 MHz	Space satellites
138 - 144 MHz	Military band
144 - 148 MHz	2 meter Amateur Radio band
148 - 150 MHz	Military band
150 - 174 MHz	VHF High band Government & Civilian
174 - 216 MHz	Television channels 7-13 audio
216 - 220 MHz	Marine/Aero navigation beacons
220 - 222 MHz	Mobile radio band
222 - 225 MHz	Amateur Radio band
225 - 400 MHz	Military aircraft
400 - 420 MHz	United States Government
420 - 450 MHz	Amateur Radio band
450 - 512 MHz	UHF civilian band
512 - 800 MHz	UHF Television channels 14-69
800 - 860 MHz	Cellular telephone, microwave mobiles

CHOOSING A SCANNER

The toughest decision you will make in the hobby of radio communications monitoring will be choosing the appropriate scanner. The question asked repeatedly by beginners and experts alike is: "Which scanner is best?"

To be totally honest, no scanner stands out as the best. Anyone who has ever owned or operated a scanner has an opinion as to which one is the better model, and they'll even bore you with a long list of the unit's good points. They sometimes use a variation on a standard phrase which you should always be wary of: "I'll tell you the best scanner on the market. You shouldn't buy anything else but this one." Beware of that statement, as it speaks highly of someone who is vastly misinformed about scanners. Take their advice and you are liable to end up back in the electronics store in a matter of months, looking to upgrade to another model.

I'll tell you what I tell my friends who ask me for advice regarding a scanner purchase: There is no best scanner, but there are some basic features which are best to have incorporated into a scanner. Find these features on a scanner that meets the bounds of your pocketbook and you will have *your* best scanner. Advanced features separate the dinosaurs from the top-of-the-line high tech.

Programmable versus crystal controlled

There are two classes of popular scanners currently on the market: the programmable and the crystal controlled.

Programmable scanners feature keyboard entry buttons which allow any frequency within the scanner's frequency ranges to be instantly entered and received. These so-called direct entry programmable receivers are the most prevalent and provide the most flexibility. For serious scanning, there's nothing like them.

Crystal controlled scanners have fallen out of popularity, however some can still be found in electronics stores. For each frequency you wish to monitor, an appropriate crystal must be purchased and installed in the receiver. Eight to ten crystals are usually the limit and therefore severely restrict a listener's flexibility. Serious communications monitor's opt for programmable units, while volunteer fire fighters or those whose only interest are one or two frequencies, might find success with crystal controlled units.

Handheld versus table-top

If you browse the shelves of equipment at the local electronics store, you will notice two types of scanners: Table-top or base models which are designed to be used in a home, and handheld units designed for use while on foot or away from home.

Most table-top units can be adapted for use in a vehicle with the addition of a cigarette-lighter adapter cord. Many handheld scanners can be run in the same manner off of a car battery and plugged into a wall socket for use at home.

Now that you're totally confused, ask yourself this: "Will I do my listening at home? In the car? On foot? Or all three?" Serious monitors have one of each model; a table-top unit for use at home and a handheld for use while away. The decision really comes down to how much you are willing to spend for a communications set-up and where you will do most of your listening.

The secret not commonly known is that handheld scanners perform in exactly the same manner as table-top units. All they lack is audio power, which can be remedied by

attaching an external speaker, and receiving range which can be increased with a larger antenna. If you are trying to split the difference between listening at home and listening while away from wall sockets, try a handheld scanner. If you don't intend to listen away from home, go with the table-top model.

Check the specs

Many people become involved in scanning because of an interest in a particular service, such as law enforcement. They aren't interesting in listening to any other communications besides law enforcement radio. Therefore, features such as wide band coverage and a large number of memory frequencies aren't necessary. However, many find that their interests grow with time. If this is a possibility with you then think about band coverage.

Band coverage is the frequency ranges your scanner is capable of receiving. Check the specifications before you buy by asking a salesperson or reading the box description. Scanners generally cover 29 - 54, 136 - 174 and 406 - 512 MHz or some variation on these ranges. Take a look back at the band plan discussed earlier and you will see what types of communications occur within these ranges. Notice that 108 - 136 MHz, the civilian aircraft band, is absent. Only top-of-the-line units cover this range, so if you are interested in aircraft monitoring, check the specs before you buy!

In addition, the 800 MHz band is becoming a popular listening target for monitors A large number of public safety agencies are moving their communications here. Your local police and fire departments might be next so consider a scanner that receives this band. Once again, only top-of-the-line scanners cover this range, so check the specs!

Channels

Memory channels are imaginary slots into which frequencies are entered. If your scanner only has ten channels, then you will only be able to scan ten frequencies at a time, no matter what frequency ranges it's able to receive.

Today's modern scanners are able to continuously scan 100 to 400 channels, depending on the model. This number is sure to increase and very soon we may be looking at units that scan thousands of channels. (Modifications can already be done to permit this on many units.)

When you select a scanner you will be faced with a choice of channels. Do you choose the 100 channel model? 200 channel? 400 channel? Personally, I believe that four hundred channels are about the limit that a scanner owner can fill, use and keep track of. There are arguments for and against that statement, but in over a decade of scanning I have never found the need for more than four hundred memory channels. It's a highly individual decision and it might be tempered by money — the more channels on a scanner, the more it will cost you.

Search feature

"Search" is the workhorse feature of any scanner. It allows a lower and upper frequency limit to be set, at which time the scanner will search through every frequency between the two, stopping on the active ones. These active frequencies can then be entered into the memory channels for further monitoring.

If there's any advice I can give you about scanner features, it's this: Don't walk out of a store with a scanner that doesn't have a search feature. You will be hamstrung without it. "Search" allows new, unpublished frequencies to be found. Understand that

what the scanner does normally is scan through its memory channels, which are preset manually by the user (that's you!) Searching is a totally different feature, which involves allowing the scanner to sample each and every possible frequency between the two values you have given it to search.

We'll talk more about the search feature later, but suffice it to say that it should be a mandatory feature on any scanner you purchase.

Technical Terms

Walking into an electronics or communications store is like stepping into another world. You can easily be dazzled by all the bells and whistles and equally confused by terms the salespeople will throw at you in an effort to prove which model is best and which you should put your money on. I'm not an engineer, so I usually approach the technical nuts-and-bolts side of scanning with a pre-selected attitude: "How will it affect me when I sit down at the scanner to listen?"

You'll find antennas everywhere, especially atop businesses who dispatch mobile units in the field.

Sensitivity

The ability of a scanner to receive weak signals is called sensitivity. Typical sensitivity for a scanner should be around 0.5 microvolts (millionths of a volt). Sensitivity becomes important only if you live in a metro area where strong signals abound, bombarding the receiver and causing reception problems like overload.

Selectivity

A scanner must differentiate between a signal it is hearing on one frequency and a signal interfering from an adjacent frequency. This is called selectivity and once again, its importance to the monitor is realized in metro areas or areas where broadcast towers are close to the receiver site.

SCANNER ANTENNAS

The antenna is the "ears" of the scanner. You can have a top-of-the-line receiver, but the antenna it is connected to determines what signals the unit can hear and how well it can hear them.

I've used many things as substitute antennas, from paper clips to various lengths of wire, and they all conduct signals. But, as scanner owners, we want to do more than just pick up signals. We want to utilize an antenna that will receive well over the entire spectrum of frequencies that the scanner is capable of hearing. Good, clear reception is the goal.

Table-top scanners come equipped with a silver extendable whip antenna that usually screws into a receptacle on the top of the unit. This whip is fine for hearing local signals, but transmitters beyond about twenty miles will be out of reach. The same goes for the black "rubber-ducky" helical whip that most handheld units come supplied with.

Trees, tall buildings, hills and the natural curvature of the earth impede all but low band (30 - 50 MHz) signals. Therefore, good reception depends on a good antenna. For a table-top scanner, try attaching an outdoor ground-plane roof-top antenna, or an extendable indoor whiphip. For a handheld, try a silver extendable whip in place of the "rubber-ducky." You will find reception greatly improved.

"The higher the better" is an old maxim that can be applied to antenna reception....however, there is such a thing as going too high with an outdoor antenna. This is due to signal losses in the coaxial cable connecting the antenna to the receiver. The longer the cable, the more signal loss. Also, the higher the frequency, the more signal loss.

There are different types of coaxial cable available which will help to limit signal loss. Folks that work with antenna systems will tell you that the lowest signal loss occurs when using RG6 or RG8 coax. This might be true, however, for runs under fifty feet, I have found that RG58 works just fine. I regularly listen to stations one hundred miles away and low band signals three thousand miles away with this type of cable attached to a ground-plane antenna mounted above roof-level.

With any antenna, always make sure the end connectors match the antenna input on the scanner. There's nothing worse than coming home to find you need to return to the store for an adapter.

SCANNER ACCESSORIES

A scanner is but one piece of equipment in the scanner monitor's radio room. Before long other essentials start to accumulate and, depending upon how far you wish to take it, you can easily end up broke (but well informed!) in a short amount of time.

What is considered indispensable for listening can vary wildly from one person to the next, but common ground can be found. What follows is a list of items I have found to be helpful. Feel free to add your own indispensable accessories.

Batteries

For handheld scanner users, batteries become almost as important as air and water. Without them, the scanner quickly dies, cutting off the all-important flow of information that is the central reason for its existence. Normal alkaline batteries work fine for those scanners that utilize them, however their useful life is limited. Once they run down, it's time to find a trash can and a store to buy a few more. Because of the expense that eventually results, many scanner owners choose to purchase Ni-Cad (Nickel-Cadmium) rechargeable batteries.

Ni-Cad's cost more to purchase at the outset, but they quickly pay for themselves. These batteries can be recharged thousands of times, and some scanners are able to recharge them within the unit (check your owner's manual for details.)

In all cases, handheld owners should always have back-up batteries available and use the DC wall power jack whenever possible to conserve battery power.

External speakers

For some reason, people tend to play radios at high volume. Whether this is a reflection on the state of our society's eardrums or the sad condition of our radio's audio output escapes me. What I am sure of is that many scanners can benefit from the services of an external speaker.

Recently I was standing near an accident scene, handheld scanner at the ready. Behind me were two sheriff's patrol units, a fire engine and ambulance, all with generators and engines running loudly. Around me where a group of people all discussing the incident and overhead came an aeromedical helicopter, its rotor blades saturating the area with sound. I had to hold the scanner up to my ear to hear anything clearly. This is a perfect example of a place where an external speaker —clipped to my lapel or pocket — would have helped enormously.

Table-top scanners generally have their speaker located on the top panel, directing the sound straight up into the air and away from the listener. If you mount your scanner on a shelf or in a car, the speaker is likely to become blocked and you will lose precious audio power as the sound is absorbed by whatever is in the way. Handheld scanners suffer from small speakers and low audio output.

Go mobile with a handheld, lapel speaker for better audio and extendable antenna for those hard to hear stations.

External speakers come in many shapes and sizes, but they all serve the same purpose: to direct the sound at the listener, not off into space. I won't go into the technicalities of speakers, but suffice it to say that if you are having problems hearing your scanner, look toward an external speaker attachment. Most scanners have a speaker or earphone jack, both of which should work well. Check with your favorite electronics store for the proper speaker and connections.

Headphones

The best accessory I have ever found for a scanner, either table-top or handheld, is a pair of headphones. Nearly any pair of headphones will do. I use stereo headphones directly off a Walkman radio. For listening privacy and clarity, you can't beat them.

Scanner manufacturers usually provide a headphone jack somewhere on the body of the scanner — look on the front or rear panel. 1/8" or 1/4" jacks are popular and adapters are available so that any pair of headphones can be used. Remember that most jacks allow only monaural reception, which means only one ear of the headphones will operate. A stereo adapter will fix that problem.

Some folks like to listen in on security patrols at the local shopping mall. Walking around with a scanner that's blaring with security communications is likely to draw some unwanted attention. Here's a perfect place to use a pair of headphones. With the scanner secreted on your belt or in a purse, you will look like any other Walkman-be-decked shopper.

Frequency Counters

On a trip with a friend, while stopped at a red light, I looked left at the car parked next to us and noticed the driver speaking into a radio microphone. I took a quick look at the antenna on the car and made a wild, half-informed guess as to what frequency band he might be transmitting on.

While I scrambled to figure this out, my friend pulled a sleek black gadget from his coat pocket, extended the antenna, flipped a few switches and said, "154.025."

I was in awe, as evidenced by the sound of my jaw dropping. Either this guy was a electronic telepathic magician, or he had discovered a scanner gadget that I hadn't.

He had. The frequency counter, as I learned very quickly, was a neat little tool of immense use to a scanner owner. First, I'll tell you what a frequency counter isn't: it isn't a scanner, it isn't illegal (as far as I know) and it isn't magic. What it is can be just as easily explained. The frequency counter is designed to read-out the frequencies of transmitting radios, and as such it is an invaluable device for technicians bench-testing transmitters in the laboratory, to assure they are operating on frequency.

For the scanner monitor the frequency counter becomes an instrument for discovering frequencies in use "in the field." It is very much a hands-on unit; you can't turn it on, sit back and expect every frequency of every transmitter in the city to be displayed. You have to go out and hunt for them.

The unit's receiving range depends greatly on the power output of the transmitter or will on the antenna used, transmission frequency, atmospheric conditions, adjacent transmitter interference and weather conditions. I sometimes think the phases of the moon and relative position of the planets also factor in! Because of the broad-band nature of the unit, you should get as close as possible to the transmitter for an accurate read-out. As an example, I had to place the antenna of the counter almost alongside a transmitting cordless phone antenna in order to get a good response, but when a train passed by one hundred feet away, the counter responded accurately to the transmitter being used.

In any event, this remarkable device can be used to display the handheld, base or mobile transmitter frequencies of police, fire, train, taxi, bus, aircraft, etc. They work quite well and are a great accessory to accompany a scanner.

Pacific Bell radio tower atop a downtown building. Parking nearby with a frequency counter netted frequency 152.480 - PacBell paging services.

Books

The greatest ability of a scanner user is the ability to learn. It's what we do when we first turn on the scanner, hunting through meaningless numbers for voices. It's what we do when we finally track down an elusive transmission by the FBI. We learn. As we learn, we become adept at the hobby of radio communications. We pass on our knowledge to others, but we never cease learning.

Books — like the one you hold in your hands — are an invaluable resource for learning about radio. I would say that over fifty percent of what I know about communications I learned from books and magazines on the subject. The other fifty percent was learned the old-fashioned, trial and error way.

Another thing about learning: ask questions, ask lots of questions. The smartest people are those who are willing to ask and learn.

Maps and Charts

No matter what kind of monitoring you do with your scanner, you will always need a map. Not a map for navigating the radio, but a map for navigating around what you hear on the radio. The first thing you will notice upon turning on the scanner is the deluge of place names, streets and locations that almost every agency on the airwaves uses. When a police officer is dispatched to a call, he is given an address. When a taxi driver is given a call for a pick-up, an address is used. When a pilot calls the control tower to report his position, he gives a geographic location over the earth.

In order to make sense out of the stream of names you are sure to hear on the scanner you might want to purchase a good street map of your area. These can often be found (for free occasionally) at the Chamber of Commerce offices for your city. Start with this local map to help tune you in to what's going on around you.

A map of your county or even state is a good idea for tracking longer range communications or incidents. Aeronautical listeners might want to purchase aviation sectional charts for their area. Regardless, one step on the stairs to becoming well informed is to become familiar with your area. Maps help you to locate military installations, power plants, rivers and lakes, airports, jurisdictional boundaries and, of course, streets. This information, in turn, leads to listening opportunities. Say you discover that only twenty miles away is a river or lake. Try scanning the marine band for boating activity. An airport just over the hill? Try the aircraft band. Did you hear a fire call? Look up the street name and see just how close that toxic spill or fire is.

Listener Logs

When I talk to folks about scanners and monitoring in general, I always ask them about their logs. Not the ones in the fireplace, but the written logs they keep next to their scanners. Many times I get blank looks.

Just like keeping a diary, keeping a listener's log is an indispensable way of tracking active frequencies throughout your monitoring career. Literally volumes of information will come your way as you listen: frequencies, numbers, call signs, names, bit and pieces. The mind is a great repository, but it has the uncanny ability to forget important information just when it's most needed. Nowhere is this maxim truer than in the field of scanning.

A notebook, whether it be loose-leaf or bound, should occupy a prominent position next to your receiver. Here is where all the miscellaneous information you hear will be recorded. I have two notebooks - one for noting new frequencies that I've heard and one for jotting down arcane information such as call signs, names, and codes. Later, if you are computer-equipped and so wish, you can retype all of this into a manageable form. For now, notebooks will work fine and you will never need to reach far for them.

I can't stress to you how important it is to keep logs. There have been times when the information I had written down helped me to understand what was going on over the air. By keeping a list of police unit numbers, I am now able to determine shifts, types of units, beat areas and even officer names. All because I kept a record of what I heard.

Managing frequency banks creates a list all its own. My table-top scanner holds four hundred frequencies in banks of twenty channels each. Without a list of what frequency is on which channel, I would become hopelessly lost. If you should ever have a power failure, you might find, when the juice is turned back on, that all of your frequencies have been deleted from memory. Though most scanners deal with this emergency by providing space in the unit for a back-up battery, there might come a time when that fails also. You will definitely thank yourself for keeping a channel list.

As scanner monitors, everything we hear over the air is important. Understanding what we hear is vital. The key to understanding is research. As an example: I have a list of unknown codes. These are codes I've heard used over the air, but haven't been able to figure out yet. One of these codes is used by tow truck drivers and dispatchers...it's known as T-6. For the longest time I could not figure out what T-6 referred to, yet it was commonly used. Eventually, a dispatcher sent a unit out on a T-6 call and the unit responded by saying, "Okay, I'll handle that vehicle lock-out as soon as I finish with this one." Bingo! T-6 was a vehicle lock-out. I wrote it down and now have one less unknown code on the list.

What all this means simply is, if you don't understand something you hear, write it down. Someday, some time, someone will say something that will clear up the confusion or at least lead you toward understanding.

TECHNICALITIES

Don't be alarmed, this is the fun part, the nuts and bolts of scanning. I've got the wrench, so settle back. We're going to talk about are some terms that you will encounter sooner rather than later.

Seven-digit frequencies

The first thing you will notice while perusing a list of frequencies is that some frequencies extend four digits past the decimal point. 160.225 might be the Amtrack train road frequency, while the yard frequency might be shown as 160.3625. Entering the seven digit yard frequency into your scanner might result in the readout becoming 160.360. Obviously, this is not correct...or is it?

Your scanner has rounded the frequency off to the nearest acceptable number. It's not wrong. Most frequencies are 16 kiloHertz wide, meaning that tuning slightly above or below the actual listed frequency will still enable the scanner to receive it clearly. An example of this is tuning an analog dial FM radio to your favorite music station. The strongest signal is received exactly on frequency - say 95.9 MHz. However,

if you tune up or down slightly, you can see that you are still hearing the station. Reception degrades the farther away from center frequency you go.

When your scanner rounds an entered frequency off by one digit, it's not straying far from the actual frequency. You will still be able to hear transmissions clearly.

Reception Modes: AM, FM, NBFM and WBFM

Sooner or later you will come across a transmission that is distorted or odd-sounding and you might believe that your scanner has tuned voices from Pluto. Not so! Just a moment ago, when we talked about the width of a given frequency, I mentioned that FM broadcast band music stations operate with around a 16 kiloHertz width — about eight kiloHertz each side of center frequency. What I didn't mention was that this is known as operating in Wide-Band FM Mode (abbreviated WBFM.) FM broadcasts and Television sound is heard in WBFM.

Police, fire, transportation services, Amateur Radio, etc, operate in Narrow Band FM Mode (NBFM or NFM). The width of the frequency is much narrower, about +/- 7.5 kiloHertz, hence the name. Ninety percent of the two-way radio traffic you will listen to will be operating in NFM.

Both civilian and military aircraft (108 - 137 and 225 - 400 MHz) operate in AM mode, with about 6 kiloHertz band-width, as do most CB transmissions.

Most scanners have preset modes, meaning that the scanner will adjust each frequency to the appropriate mode as it is tuned. Advanced scanners have a provision for manually changing the modes, which is helpful if, say, the present for 225 - 400 MHz military aircraft band is NFM. Manually selecting AM mode will allow clear reception of this band.

Trying to tune a WBFM mode radio broadcast using AM mode would result in static-filled distortion. And vice versa. We'll talk more about reception modes in the special section on monitoring the President.

Simplex, Duplex - System Types

The very simplest type of radio system is "one-frequency simplex" in which all radios receive and transmit on the same frequency. They cannot do both at the same time, and when they try it results in a high-pitched squeal or distortion. Simplex communications are subject to line of sight rules, which means their range is limited. Most handheld radios use simplex communications.

Two-frequency simplex utilizes two frequencies, one for input, the other for output. An example of this would be hospital/ambulance frequencies between 463 - 464 MHz. The ambulance transmits on one frequency and the hospital on another. Although it's all academic to the users, whose radios adjust for this without manual control, it becomes a problem for a monitor, who must understand what's going on in order to hear the entire conversation.

Listening to two-frequency simplex communications requires that the monitor switch between both frequencies (for instance, listen to 463.175 for the ambulance side of the transmissions, and immediately switch to 468.175 for the hospital side. Going back and forth between the two frequencies as the conversation shifts will enable you to hear the whole story.)

Two-frequency duplex is the mode used in normal telephone transmissions, with both parties transmitting and receiving simultaneously. This mode is rarely heard on

VHF\UHF bands, but does see some use in specialized areas such as ship to shore marine telephone transmissions, air to ground aircraft telephones, cellular and cordless phones.

Repeaters and Extenders

A repeater system (often indicated in frequency lists by the letter "R") is a base station that receives input on one frequency and re-transmits on another frequency from an antenna usually located on a hilltop or high-rise building. This "repeating" of the signal allows mobile units, with limited range, to be heard over greater distances.

Mobile extenders are vehicle mounted "mini-repeaters" that allow a handheld radio's transmissions to be repeated from the higher powered car radio and therefore have more range than if the handheld were transmitting solely on the strength of its limited power and short antenna.

Low Power Units

Cordless telephones, walkie-talkies, cordless microphones, and some handheld radios intended for extremely short range communications are known as low power units. Transmission power is usually no more than two watts. Listening to these communications with any reliability requires your scanner to be very close to them.

Listeners who tune the cordless telephone band and expect to hear every phone in town will be sorely disappointed. Reception of these units is not only hampered by low power, but also by the line of sight rule. Buildings, houses, hills, and tall trees will absorb or deflect signals.

If you do happen to be close to an amphitheater, stadium or concert hall, low power transmitters can be a fun target.

KNOW THY SCANNER

Your scanner can become your best friend if you learn how to use it correctly. There is no substitute for actually sitting down at the keyboard and exploring. Exploration means reading the manual, first of all, and learning the ins and outs of the unit. Once this has been mastered, you're set to begin scanning.

If you're a first-timer, with a brand new scanner before you, then you'll need to become familiar with the bands available on your unit. Do this by punching in frequency ranges and searching between them. Get a feel for what bands contain what services. Make notes so that you don't forget interesting frequencies. Spend time going through the bands, choosing small sections to scan at a time. Familiarity breeds expertise.

Read all you can about scanning and subscribe to a scanner magazine or two to keep you up to date on the latest news and methods. Your education in communications will never end, as new technologies come into use and new systems go on-line. There is always something to learn.

If you're serious about scanning, then you will spend the time necessary to learn the ropes. It might seem overwhelming at first — it did to me, too! — but time teaches well. Your persistence will clear the fog and allow things to "click." When they start clicking, you'll know it, because you will begin catching the action on the air and you'll get that itch everytime you're away from the scanner...the itch that remains unscratchable until you get back to the scanner again.

Popular Targets

A Guide To What's On The Air

The airwaves from 30 MHz to 1300 MHz are filled with transmissions from all manner of services. If you were to set your scanner to search from the bottom to the top of its usable range you would find that nearly every agency that uses a two-way radio can be found here, as well as some distinctly odd sounds that seem to have no rhyme or reason.

The air about our heads crackles continuously with radio waves, electromagnetic energy looking for an outlet to turn it into audible voices. Your scanner is that outlet. Activate the power switch and you will tap into a world that knows no bounds, from low band signals in the thirty MegaHertz range skipping in from thousands of miles away, to microwave mobile stations on the high end of nine hundred MegaHertz, the action never stops.

While others sit down for a quiet night in front of the television set, watching canned action and hearing practiced lines from actors, the scanner monitor sits down for a night of high adventure. Un-taped, un-rehearsed, un-edited, the live scanner action will take you on a fast paced trip:

Ride shotgun with police officers as they patrol the streets of your city, and respond "Code Three" into burning buildings with fire fighters.

Soar at thirty thousand feet with airline pilots and pull nine G's with military fighter jocks as they turn and burn in mock aerial engagements.

Travel with the engineer of a cross-country train, or with a taxi driver as he delivers fares all across town. Ride the route with the uptown bus or follow city maintenance crews as they go about their work.

Suit up for a radio ride with a Drug Enforcement Agency (DEA) Clandestine Lab Entry Team as they knock, announce and break the door down on an illegal drug manufacturing laboratory.

Serve warrants and go hunting for parolees with the men and women of the United States Marshal's Service and track criminals under surveillance by the Federal Bureau of Investigation.

Hit the high seas with the United States Coast Guard on search and rescue missions with ships, helicopters and aircraft.

Listen to live concert performances broadcast over wireless microphones; cordless and cellular telephone conversations, walkie-talkies and even baby monitors!

It doesn't cost a dime, just tune in and sit back, you are in for a wild ride....totally real, totally live and un-cut. This is real life on the air.

Law Enforcement

Scanning Behind The Badge

♦

"Dispatch, Two-Forty-Nine King in foot pursuit." "Two-Forty-Nine King, 10-4. In foot pursuit. Say location?" "Corner of Tenth and Garrison. Suspect is now...turning left on Garrison...running south." The officer's voice explodes in bursts over the speaker, rising and falling with the exertion of running full speed after an escaping suspect. "All units, emergency traffic for Two-Forty-Nine King in foot pursuit, south on Garrison. Emergency traffic only." The double beep of the emergency tone covers the frequency every two seconds, alerting other officers that the channel is now reserved for urgent communications only. Three other patrol units immediately call in responding to assist. Behind the officer's voices are the yelp and howl of patrol car's sirens. "Dispatch, Two-Forty-Nine King now westbound on Park Street...suspect is a white male...nineteen...clean-shaven, blue shirt, Levi's..." A muffled curse, a loud sound in the microphone and then the officer continues, his voice strident now: "I've got shots fired! Shots fired!"

"10-4, all units responding, Two-Forty-Nine King advises shots fired, now westbound on Park." The dispatcher replies. "Suspect just went into the bus depot on Park. I'm sending in the K-9." The loud barking in the background almost covers the officer's voice. "10-4, Two-Forty-Nine King advises suspect ducked into the bus depot on Park Street. Sending in the dog." Though no words are spoken, you can almost hear the glass doors crashing open as the officer orders his dog after the suspect. It is a tense few moments, waiting, wondering, seeing the possible scenes over and over in your mind. You turn the scanner's volume up louder and will the cover units to arrive quickly. Two officers call "on scene" and then: "Two-Forty-Nine King is Code Four...Code Four...suspect in custody." He can barely get the words out, his breath coming in gasps, the K-9 growling and barking furiously in the background. "Copy, Two-Forty-Nine King advising Code Four, suspect in custody. All units, clear emergency traffic." The relief in the dispatcher's voice is all too evident. Chalk one up to the good guys.

Law enforcement communications, more than any other, attract listeners to the scanner hobby. Indeed, some people still persist in referring to scanners as "police band radios" and though we know scanners are good for much more than just that, it speaks highly of a popular monitoring target...law enforcement radio.

Police officers are, by their own definition, in a high risk job. Shift after shift cops are called upon to place themselves in danger, in potential conflict situations, in order to protect the public from harm. No call is routine and every moment is spent on the razor's edge.

For a police officer, out there on the front lines, contact with headquarters and with other officers is vital. The technology that has placed officers in patrol cars now

has put radios in those cars, allowing an instant link to others within the department. Information and assistance is just a radio call away.

POLICE RADIO SYSTEM SET-UPS

Dispatch

Police departments exist to serve the public by responding to calls for service. Officers in the field receive these calls via two-way radio over a frequency most often known as *Dispatch*.

The person manning the Dispatch console is responsible for relaying calls to patrol officers that are received from the 911 emergency line or non-emergency number. When a patrol officer is given an assignment (a radio call) it is done over the Dispatch channel. When he arrives on scene he advises this on the Dispatch channel. When he calls for additional assistance, it is performed on Dispatch.

Police dispatch radio tower.

Dispatch is the working frequency on which the headquarters station directs its officers. The dispatcher must know where patrol officers are and what they are doing at all times.

In small to medium sized departments, dispatching may be performed on one frequency. In larger agencies, dispatching is often split between a number of frequencies, each frequency responsible for a different sector of the city.

Dispatch frequencies are Repeater set-ups, allowing wide coverage of units throughout the working area. Because of this, when listening to Dispatch, you will be able to hear both the dispatcher and field units. Moving up five megahertz in the UHF band (450-470 MHz) will net you the Repeater input frequency on which you will hear units operating in Simplex mode. For instance, the Dispatch channel is 453.925. The Repeater input frequency would be 458.925. Try this with a local police repeater of your own. Notice the difference in reception. 806-950 MHz input/output frequencies are exactly 45.000 MHz apart. Simplex operations are line-of-sight, as you remember. Monitors in the know listen to the Repeater frequency for best reception.

Inquiry

A police officer's job revolves around information. Getting it and giving it are what make his job go smoothly (most of the time.) The flow of information is such that a separate channel is usually set up to handle officer requests. This channel - called *Inquiry* or *Information* - is where officers in the field switch to have license plates, driver licenses, registration and names run through the city, state and national computer

databases. All manner of information is derived from these checks, from expired registration or license to wants and warrants.

Although some checks, such as preliminary license information, are occasionally relayed by the primary dispatcher, most departments maintain an Inquiry channel for this routine and often dull pursuit, as it keeps the primary Dispatch channel clear for other communications.

Car to Car

There are many instances during the course of a day or night tour, that officers find it necessary to be in radio contact with each other. If Officer Smith responds to a robbery call and arrives on scene before his cover unit does, he needs to give him a call and advise what he has found and where the second unit should set up. Unless the primary dispatch channel has been cleared for emergency traffic involving these units, the communications between them will have to switch to another channel.

Car to Car is the frequency used for inter-officer communications. It is one of the most interesting frequencies to monitor if you are interested in law enforcement. Transmissions are often very uninhibited and revealing, with all manner of information being passed, such as details about calls, problems and technical discussions, and also regular "cop talk" among in the folks in uniform.

Administration

A police department, in the course of its duties to protect and serve, generates an enormous amount of information that must be relayed from station to station, district to district and officer to officer. Much of this information does not affect the patrol division - the officers on the street - therefore, it doesn't belong on a primary Dispatch frequency.

Administration or *Staff* is the frequency normally maintained for communications between stations, stations to investigators, and stations to non-patrol units. This frequency is really a catch-all for transmissions that are of a non-critical nature. Many of the transmissions here are of interest to a monitor: I have heard SWAT Team alerting, K-9 unit dispatching, Bomb Squad communications, Detectives discussing cases, and Search and Rescue officers coordinating here. Don't disregard this frequency as unimportant.

Tactical

No one that I have talked to about police communications has ever failed to ask me about "the good stuff." Usually I feign innocence, waiting for them to be forthcoming about what this "good stuff" actually consists of. The answer goes something like this: "You know; detectives, undercover, drug busts, surveillance, secret stuff." Well, I don't know about secret, but most police departments use a *Tactical* frequency for communications related to special operations, detectives coordination, intercity, special assignment, detail, or surveillance operations. Tactical frequencies are used for just about any kind of special applications a law enforcement agency can engage in. If it requires a separate channel for coordination, Tactical is it.

Tactical frequencies are usually listed along with regular widely-known channels in frequency directories. With very few exceptions, they are not hidden away, unknown and un-revealed. Any frequency that isn't used for Dispatch, Administration or Inquiry

has an excellent chance of seeing tactical use, so keep an eye on those that appear to have little activity. Your best bet for finding Tactical frequencies is to scan around the known frequencies of a department.

Listen for law enforcement helos on Dispatch and Tactical frequencies.

For instance, Metro Police uses 154.655 for dispatching units, 155.705 for Inquiry and 154.225 for Car to Car operations. By looking at these numbers, we can infer that all Metro Police communications are licensed within the 154 - 156 MHz band. Set this band up with the scanner's "Search" function and scan it continuously for a week. I won't guarantee that you will find all active Metro frequencies within a week, it might take longer, but you get the idea.

A frequency directory, such as Gene Hughes' POLICE CALL or the Betty Bearcat Directories, are good references for police frequencies. Check it first for pertinent frequencies, but don't forget that departments sometimes use channels licensed for city or county use. These are often listed as "Local (L)" in directories. Unused fire department frequencies also might see police tactical communications. Search around!

Special Units

While it is true that Tactical frequencies see the bulk of special unit communications, some departments assign individual frequencies to such police sections as Detectives, Narcotics Enforcement, Special Weapons and Tactics (SWAT), Gang Enforcement, Vice, Air Support, Traffic, etc.

Special unit communications can be hunted down in the same manner as Tactical frequencies. Look for them in the same band as regular, known department channels.

Mutual Aid and Area-wide Commons

Police departments often work in concert with each other in areas ranging from patrol to investigations. It is not uncommon for one department to request assistance from another department for a high-risk operation such as apprehending a fugitive. Local police might work with the Marshal's Office or the FBI. Communications among officers in the field, therefore, must be clear among all agencies involved to prevent certain disaster.

Mutual Aid channels are set-up in many areas to provide radio coordination among officers participating in joint operations. These channels are accessible on all department radios. They might be countywide, statewide or even nationwide commons. 155.475 is used nationwide for police mutual aid. You will often find DEA and Customs working surveillance together here, in cooperation with local police agencies.

Check a frequency directory for Mutual Aid channels in use in your area, or scan around the dedicated police bands listed below.

In addition to Mutual Aid's used for interagency work, some larger departments maintain citywide common frequencies on which officers from different sectors or districts can communicate. Keep an eye on these, they might see Tactical use occasionally.

CODES

Part and parcel of a police officer's job are codes. Used in radio communications to describe everything from unit numbers, beat areas, and locations to call types, dispositions and violations of law, radio codes are an important part of monitoring police communications.

Unit ID Numbers

One Adam Twelve, Two Forty Robert...you have undoubtedly had some exposure to police radio in the form of codes used to identify individual units. In the early days it was much simpler: Officer Jones called in from his post at Grant and Winston Streets. Today, Two Eleven John makes the radio call and that ID says it all.

Unit ID numbers were created to develop some semblance of order on the airwaves, to save valuable seconds and to express a great deal of information in a very short time. In most cases, unit ID's, properly decoded, reveal the following:

- Officer name(s)
- Beat area
- Type of unit
- Special info, such as rank

Let's take Two Eleven John as our example of a fictional unit with a fictional department. Metro Police units in each of the five patrol areas have call signs beginning with a number: 1 is Downtown, 2 is East, 3 is West, etc. Each officer is assigned a number from 01 to 99. (Though the monitor will not know which officer has which number, the dispatcher has this information, enabling rapid identification of individual officers.) Letter codes indicate type of unit, J or John is a one-officer patrol unit. Adam might be a two-officer patrol unit, Mary a motorcycle officer, King a K-9 unit, Ida an investigator (detective.)

Take notes on the unit numbers you hear in use by your local police. Over time, you will be able to determine which numbers refer to which beats by keeping a geographic list. The same reasoning works for determining types of units.

10 and 11 Codes

"Two Eleven John will be 11-48'ing one 10-16, 10-19." In the space of two or three seconds, this officers' transmission has given the dispatcher a volume of information that would take at least ten seconds to relay in plain language. What he has said is: "Downtown one-man patrol unit Officer Collins will be transporting one prisoner to the station." That's confusing for a dispatcher swamped with incoming information. Hence, the value of the 10 and 11 codes. They provide brevity, and clarity to transmissions.

10 and 11 codes vary wildly from department to department and even from state to state. The example I gave above was from the San Diego (California) Police Department. In other states, these numbers are totally different, changing the meaning of the transmission. In the same way that we puzzle out unit numbers by keeping notes, 10 and 11 codes can be deciphered by listening carefully and repeatedly to the context in which the codes are used. Check with other monitors in your area or use a frequency directory to give you a boost.

Jargon and Abbreviations

Once they get rolling using radio codes, officers often take it to extremes, abbreviating everything in sight. Around here, when a person has been drinking, officers say he's HBD. When an arrest has been made and a report filed, it's AM, RF. When a call is unfounded, it's a "U".

Police jargon is a whole different language from the one you and I speak in civilian life. Figuring it out is half the fun of listening. Here a tip: if you can't find another monitor or a electronics store employee to help you understand cop talk, make a list of all the codes and abbreviations you hear over the air. Listen carefully to contexts, usages, sentences, and eventually you will make progress. Maybe shortly after a unit calls "10-8" he is assigned to another call...this would indicate that 10-8 means "clear from last assignment." A few minutes after a unit is dispatched to a call you hear him say, "10-97." This must mean that he has arrived on the scene. It's all a matter of deduction.

MONITORING MOBILE DATA TERMINALS

Mobile Data Terminals are revolutionizing police communications. MDT's are vehicle mounted control units resembling lap-top computers, which electronically "talk" to the dispatcher's computer system and other MDT's. Messaging between dispatcher and field units and between officers in the field is done without the use of voice. Mobile Data Terminals work something like this:

1) A Police Department receives a telephone call or desk appearance from a citizen requesting assistance.
2) The police 911 phone dispatcher or desk officer who answers the call enters the basic call information into the department computer, which matches the call location with a geographic base file and routes it out to the appropriate dispatcher.
3) The computer also assesses the availability of officers on the specific beat where the call originates from and assigns one to answer the call. The system might also be programmed to search local, state or national databases to determine if there are any active records for the persons involved in the call. Also, information about prior calls for service from that address can be displayed.
4) Lastly, the computer sends the bulk of this information, in condensed form, to the dispatcher responsible for that geographic area. From there it is dis patched by radio or MDT to a field patrol unit.

Mobile Data Terminals are heard on a scanner as a series of beeps, blats and buzzes that are unmistakable to the monitor. There is no known way (yet) to computer decode the data flowing over the frequency.

LAW ENFORCEMENT FREQUENCY RANGES

So, where do you find all of this police action? The following compilation of police related frequency bands should put you on target.

37.020 - 37.400
39.020 - 39.980
42.020 - 42.940
44.620 - 45.050
46.100 - 46.550
154.025 - 154.115
154.560 - 154.950
154.960 - 154.995
155.010 - 155.400
155.415 - 155.500
155.730 - 156.150
156.150 - 156.240
158.730 - 158.955
158.985 - 159.030
453.0125 - 454.000
460.0125 - 460.5625
471.1625 - 471.4625
471.4625 - 471.8125
482.3125 - 483.1375
483.4625 - 484.8125
489.1625 - 489.4375
494.3125 - 495.1370
495.1625 - 495.8125
500.3125 - 501.1380
501.1625 - 501.4375
501.4625 - 501.8130
506.3125 - 507.3125
810.0000 - 816.0000
821.0000 - 824.0000
855.0000 - 861.0000
861.0000 - 869.0000

FIRE COMMUNICATIONS

High Octane Listening

♦

So often in the dead of night I awaken to the sound of sirens, high-pitched and howling, that signal engines rushing off to battle the flickering enemy called fire. As the sound draws closer, I will rise to turn on the scanner. Doing this puts me in contact with what's burning in the city and I learn why people are racing through the streets while I sleep.

Fire! Yell it in a crowded theater and you will unleash crushing terror. Yell it to a scanner monitor and you will likely find that at least one bank of frequencies within his scanner will be devoted to fire communications.

Regardless of size — from one-engine, two-man volunteer units, to multiple-engine, battalion sized city stations — the fire department is responsible for fire protection of our cities, rescue response and in most areas, emergency medical services. They answer when the hazards of life threaten.

FREQUENCY TYPES

Dispatch

A fire company does not roll anywhere until they get the message of who is to respond and where they are to go. *Dispatch* (also known as Primary or Control) is where all calls for service are handed out. Dispatch may be one frequency or it may be divided into a dozen frequencies, each one responsible for dispatching units from different sectors of the city.

Regardless, calls heard on Dispatch frequency are usually preceded by "tone-out" audio tones that activate teletypes in selected stations. As the call location is being broadcast verbally over the air, it is also printed out on hard copy in the station house.

Econdido, CA Fire Department Brush 1363 rolling out to a call. Heavy duty units like these can make access to brush and vegetation fires through tough driving conditions.

Some fire monitors claim that you will be able to tell which units are being dispatched solely by the sound of the "tone-out" tones themselves.

Response

Many departments maintain a *Response* channel on which are heard units calling in to confirm receipt of the call. All follow-up communications to the original dispatch are usually conducted here, so monitors who wish to follow a call are advised to switch to the response channel after the call goes out on dispatch.

Fireground

Once on scene, fire units coordinate their efforts via a simplex channel known as *Fireground*. This tactical frequency serves as a link between fire fighters engaged in a call, and is an extremely interesting channel to monitor. I tune to fireground to hear details that I would miss if I remained on Dispatch or Response channels:

Fire fighters engaged in a hazardous materials response to an accident scene discuss details (type of chemical, location, persons injured, danger to the surrounding area) on Fireground frequency and then switch to the Response channel to request additional "hazmat" units.

Fire fighters communicate with an aeromedical helicopter on Fireground frequency, relaying details of the patient's condition, and coordinating the helicopter's landing.

First responders that arrived at an industrial accident scene related victim details to an incoming rescue unit that was enroute, but had not arrived yet.

Fireground frequencies might be arranged according to area, in which each geographic city area has its own channel, or they might be arranged in a citywide and countywide method in which one frequency serves as fireground for all units. Each department or battalion might also have its own dedicated fireground channel.

Fireground frequencies are low power — often two watts output. Look for them on the following FCC designated frequencies, as well as department system assigned channels: 33.420, 46.300, 153.830 and the off-set frequencies between 460.5125 - 460.6375 and 465.5125 - 465.6375. Look also for low power fire communications on frequencies within the 453 - 454 and 458 - 459 MHz bands.

Command

With all the tactical details being handled on Fireground frequencies, it is often no place for communications between the on-scene commander and headquarters. These transmissions are often handled away from the hustle and bustle on a frequency known as *Command*.

Command exists as a channel on which the headquarters dispatcher can establish instant contact with the man in charge at the scene, and vice versa. Information such as additional units required, special equipment requested, status updates and crew coordination take place here.

Not all departments utilize a command channel. Some relay this information on Dispatch or Response frequencies, but the goal is to free up the air for urgent communications. This means relegating non-critical communications to their own channel.

Mutual Aid

Fires often burn out of control, requiring additional support from other departments in the immediate area. Plans are usually drawn up designating "mutual aid responders," which are units from neighboring towns or cities that will come to assist the primary engines if requested. Many situations are designated to receive "automatic aid" in which nearby units respond automatically to support departments at certain calls.

Regardless, when you have two or more departments working in concert, communications between them is critical. So often, one department's radio system will not be compatible with another. Radio frequencies are not the same and one department's units will have no way of communicating with another's. Hence the importance of Mutual Aid channels, a common frequency or frequencies to which all departments within a geographic area have access.

On Mutual Aid frequencies you will hear fire units coordinating with each other, much like the transmissions that take place on Fireground tactical frequencies. A wise scanner monitor always determines which Mutual Aid frequencies are in use in his area and keeps them programmed into the scanner. You never know when they might see use.

Investigators

Arson, explosives and hazardous materials investigators commonly use their own separate frequency for communications. Undoubtedly a fascinating target for fire monitors, the *Investigators* frequency goes by various names, including Arson, HazMat, Staff or even Administration. It may take some work to find it, but it's well worth the hunt. You will hear details of cases here that won't make the news media broadcasts.

Paramedics

Emergency medical services will be dealt with in-depth in the next chapter, however it should be mentioned here that most fire departments maintain their own paramedic units which are dispatched on the same frequency and in concert with fire units. Dedicated fire department paramedic/EMS units might also have their own dispatch frequency, separate from fire dispatch.

Mask-mounted radios

Fire fighters routinely don breathing apparatus (BA's) as part of their equipment when entering a burning building or working at an emergency scene where hazardous chemicals are known to be present. Within the fire fighter's mask is often installed an internal microphone for communications.

Anyone who has spent any time listening to fire communications has undoubtedly heard the muffled, often hollow sounding voices of fire fighters as they communicated through BA radio microphones. Southern California area Emergency Rescue Team members, whose work often takes them into dangerous industrial accident sites, utilize SCUBA-type microphones which allow them to communicate clearly over standard department frequencies.

Rumor has it that fire fighters often use mask-mounted intercoms for "hot mike" (open channel) communications at emergency scenes. These devices are of short-range and low power and possibly operate within the 49 MHz band. You will have to be extremely close to the scene to hear these radios. Fire fighters say they are more trouble than they are worth, however they do see use in some areas.

CODES

Fire radio codes, much like police radio codes, are designed to keep transmissions short, clear and understandable. Though they vary widely from state to state and even department to department, radio codes are an important part of communications. Understand them and you will understand what is being said.

I wish I could give you a list of codes and say, "These are used nationwide, and are all you'll need!" It's not going to be that easy. If you know a fire fighter, you might be able to pump him or her for details. Asking at the fire station might net you a list or it might net you some strange looks. Try the local electronics store, where scanners are sold. The employees usually listen to scanners themselves and might be able to help you out. Try to hook up with other monitors in your area, either through newspaper advertisements or computer bulletin boards.

Lastly, or I should say, firstly....write down every code you hear. Listen to the context in which it is used. If you are meticulous about listening, you will eventually hear someone slip and use the plain language version of the code, or you will be able to determine what the code means by the series of exchanges between the fire fighters and dispatchers. For instance: "Rancho Fire, Engine 1413, dispatch 11-41." Well, we know the engine is requesting another unit, but we're not sure which one. The reply is a standard, "1413, copy" and that doesn't help. But, wait...a minute later, we hear, "Engine 1413, Rancho Fire, Hartson EMT's are responding from Palomar Hospital. ETA ten minutes."

Bingo! Hartson is the local ambulance company, which means that an 11-41 refers to a request for an ambulance. Easy, wasn't it? Don't underestimate your ability to figure out codes for yourself. It can be done.

California Department of Forestry fire unit, radio call 3399. State fire agencies such as CDF see the lion's share of work when brush fires rage.

FIRE!

The fire department is part of the public safety triad —police, fire, emergency medical — and provides some of the most exciting and engrossing listening to be had over the airwaves. Almost every hour of every day, sirens howl in response to a call for help. Your scanner, tuned to the proper fire frequencies in your area, will keep you informed and "on-scene."

Look for fire communications within the following frequency bands:

33.420 - 33.980
45.880 - 46.000
46.060 - 46.500
153.740 - 154.115
153.130 - 154.445
460.575 - 460.635
470.000 - 473.000
806.000 - 824.000
851.000 - 869.000
896.000 - 901.000

Emergency Medical Services

A Heartbeat Away

♦

Ninety-five percent of the time when fire calls are dispatched, a paramedic or emergency rescue unit rolls out of the station along with the engines, trucks and rigs. From fires and vehicle accidents to medical emergencies and natural disasters, Emergency Medical Services are a major part of public safety operations all across the country.

A monitor's first audio encounter with EMS often comes in the form of a medic unit being dispatched along with fire units in response to a call. "Engine 44, Medic 19, respond structure fire..." Fire departments routinely maintain paramedic teams in fully-equipped medical ambulances as part of their standard station crews.

Fire fighters themselves are rated as First-Responders or EMT's, able to give basic lifesaving assistance. Paramedics, on the other hand, have advanced training in lifesaving and trauma medicine, skills that allow them to technically bring the emergency room to the patient. Emergency Medical Technicians (EMT's) are specially trained (usually with a 120 hour training program) to provide immediate first aid care until Advanced Lifesaving units arrive. Though they do not have the advanced training of Paramedics, EMT's serve with many fire department rescue squads and ambulance teams.

DISPATCHING

In many jurisdictions, fire department medic units are dispatched on the same working frequencies as all other fire equipment . Some may have their own dispatch channel to avoid frequency congestion.

Paramedic rigs are generally tagged with the radio call "Medic," whereas the "Rescue" call sign indicates a specially equipped unit that might carry either paramedics or EMT's. Medics respond to almost all calls that might involve a need for medical assistance, and Rescue units are dispatched to calls where special rescues might be needed.

It's not uncommon to hear "Engine 44, Engine 15, Medic 1 and Rescue 18..." Each department does it differently, but my warning flag usually drops when I hear a Rescue unit dispatched, for I know the call might then involve extrication, or special rescue attempts to be handled by these uniquely trained professionals.

AMBULANCE DISPATCHING

Privately-run ambulance companies often are called on to respond with fire units, especially in smaller departments where the cost of a full-time department paramedic

team is prohibitive. In these cases dispatching is often done on the ambulance company's own private frequency. As I said, each set-up is different and you might find that, for instance, Tony's Ambulance in your area is dispatched by the fire department, with all communications routed through the fire dispatcher. This could happen!

Become familiar with who provides emergency medical services in your city. If it's a dedicated fire department unit, look for communications on fire frequencies. Private ambulance? Look both places. A little listening should clear up the question.

AMBULANCE TO HOSPITAL

Regardless of who dispatches whom, the real importance of EMS monitoring for a scanner listener is in hearing the entire story. When an injury or illness call goes out, I am able to hear the dispatch, the arrival on-scene, status reports, and medical reports to the physicians at the hospital both on-scene and en-route. This information completes the picture of an event and often leaves me with more information than the television or newspaper reports.

155.340 is a nationwide inter-hospital network frequency known as HEAR. Many first aid and ambulance units use this channel for contacting area hospitals with on-scene and en-route patient information.

The most common frequency system in use for ambulance to hospital communications nationwide is located between 463 - 464 and 468 - 469 MHz. Each channel consists of two sets of frequencies, one for ambulance to hospital, the other for hospital to ambulance. In order to hear both sides of the conversation you must switch back and forth between these two-frequency simplex channels.

Channel	Hospital	Ambulance
1	463.000	468.000
2	463.025	468.025
3	463.050	468.050
4	463.075	468.075
5	463.100	468.100
6	463.125	468.125
7	463.150	468.150
8	463.175	468.175
9	462.950	467.950
10	462.975	467.975

Each hospital is usually assigned its own pair of transmit frequencies. When a medic unit wishes to contact a particular hospital it simply calls on the appropriate frequency, establishes the contact and relays the patient information. For paramedic units whose training includes administering lifesaving medications, you might hear the hospital's emergency room physician prescribe additional treatment - either through himself on the radio or through the radio nurse.

A second set of frequencies is used in some areas for hospital/ambulance communications:

Usage	Frequency
EMS Trauma Dispatch	155.025
Medic/Hospital	155.325
Medic/Hospital	155.175
Medic to Medic	155.160
EMS Secondary	155.235
Hospital Admin	155.385
Hospital Emergency	155.340

Channel designations may differ in your area. Contact can be initiated on any medic to hospital frequency, but is usually done on a central dispatch frequency within this group.

WHEN TO LISTEN

Spend too much time on the fire dispatch or fireground frequencies and you might miss the conversations going on between paramedics and the hospital regarding patient care. This is where having a second scanner really comes in handy, but for most it's just a matter of knowing when to listen.

I usually give paramedics about ten minutes after arrival on-scene (sometimes less) to evaluate their patient. At this point, a call to the hospital for advice on further treatment is often made, while the medics are still at the scene of the call. Begin listening for medic/hospital transmissions as soon as the medics are on scene and continue to listen. Some will call the hospital almost immediately, some will wait until they are ready to load the patient into the ambulance rig, and some won't call until they are enroute to the hospital. Just to be on the safe side, keep a close watch on these frequencies as soon as units arrive.

Private ambulances, such as this Hartson rig, are usually manned by EMT's and may be dispatched by either the Fire Department or their own dispatch center.

In multiple victim cases, calls to the hospital to advise them of the situation are made almost immediately. The condition of the patient often dictates the urgency with which contact with the physicians at the hospital is made.

Telephone contacts

It is not unusual for paramedics to call the hospital emergency room on the telephone at the scene, if that happens to be a home or business. Paramedics once responded to a call two doors down from my house. That home had a cordless telephone and the medics relayed patient information over the phone to the hospital.

Cellular telephones see use in medical rigs also. Medics at the scene of an accident nearby once made contact with a hospital via cellular and the line remained open for updates all the way to the hospital. In the background could be heard medics speaking to the patient, discussing treatment, radio transmissions, and the siren going as they sped Code Three to the hospital. What a treat to be able to ride along by radio! Don't neglect the 869 - 896 MHz cellular telephone range when looking for medic/hospital communications, especially if normal medic/hospital frequencies do not appear to be in use at the time.

OTHER PLACES TO LISTEN

Look for ambulance and medic communications between the following frequency ranges:

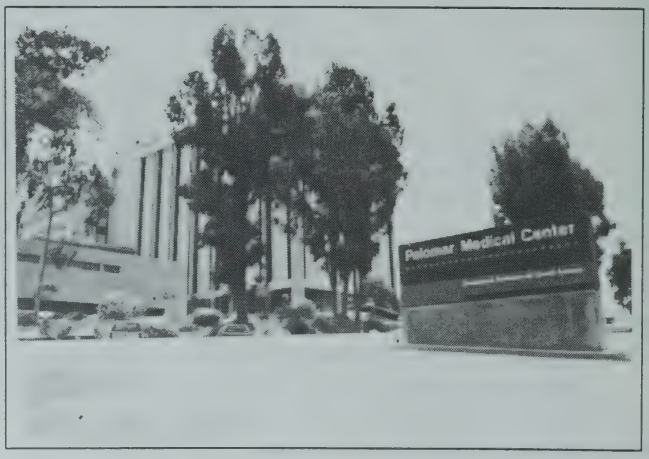
33.000 - 34.000
37.000 - 38.000
46.000 - 46.500
153.000 - 156.000
460.000 - 464.000

EMERGENCY CALL

When the dispatch goes out and paramedics roll with lights and siren, it is an emergency call. Somewhere, someone is in trouble and the scanner monitor, whose fingers bring up the correct frequencies, is able to instantly go along.

You will hear many things while listening to emergency medical services at work, from mundane scrapes and bruises to traumatic vehicle accidents. Your scanner will allow you to hear the voices of medics as they struggle in less than perfect conditions to save a life, as they laugh and even cry under the tension of responding time and again, day after day to serious emergencies.

There will be one call that will always stand out, that you will remember and tell to others. For me it was a drunk



The modern hospital is the destination of every ambulance. Palomar Medical Center in California is also a trauma center and lands aeromedical helicopters on its helipad.

driving accident involving three cars and multiple injuries. Men, women and children were among the victims, some ranked as "serious trauma" cases. It eventually took three ambulances and two Life Flight aeromedical helicopters to transport them all. The driver of one of the vehicles was in cardiac arrest, and as the ambulance raced to the hospital I listened to paramedics in constant touch with the emergency room physician, administering medication and trying desperately to regain a heartbeat.

It was gripping drama, with a real human life at stake. You won't find that on television — it's something that can't be recreated — but you will find it on the scanner bands.

Aviation Monitoring

Hearing The Wild Blue

Aviation is inherently dangerous. Lifting tons of metal, aluminum and composite materials into the air, and forcing all of the parts to fly in close formation at high altitudes for extended periods of time is an ominous undertaking. Yet it is done regularly, every minute of every day, thorough weather ranging from ceiling and visibility unlimited to risky thunderstorms.

Nearly 20,000 scheduled airline flights lift off from our nation's four hundred major airports each day, traversing the nation in company with thousands of private, corporate and military aircraft, forming a web of air traffic. This web in the skies is controlled and watched over by air traffic controllers, who use radar displays and VHF radios to maintain contact with their airborne charges twenty-four hours a day.

Two-way VHF (Very High Frequency) radio plays a big part in the world of flying: from start up to shut down, aircraft are herded and instructed by controllers via radio. Let's look at a few of the major types of controlling facilities:

CLEARANCE DELIVERY at many airports is responsible for issuing flight plan clearances to aircraft. Without a clearance detailing route of flight, approved and issued by air traffic control, aircraft flying IFR (Instrument Flight Rules) cannot leave the ground.

GROUND CONTROL preserves order on the surface of the airport, directing taxiing aircraft from hangers, parking areas and airline terminal gates to and from runways. The FAA Ground controller is the earth-bound traffic cop whose waving hands are replaced by a two way radio.

A Southwest jet on final approach for the runway.

TOWER takes charge of aircraft operating within five miles of the airport, sequencing airplanes into the traffic pattern for landing and clearing aircraft for take off. Tower's domain is absolute: aircraft within the five mile area must be in radio contact with the controller to receive instructions, sequencing and proper separation.

DEPARTURE CONTROL handles all flights as they transit from the airport terminal area into the cruise portion of flight. Departure control maintains safe separation of aircraft under his control, and provides heading and altitude instructions as necessary to guide the aircraft onto course for his flight.

AIR ROUTE TRAFFIC CONTROL CENTER, also called "Center" and known by the acronym ARTCC, maintains twenty facilities throughout the United States charged with maintaining radar and radio contact with airborne aircraft in the enroute cruise portion of their flights. ARTCC's are divided into "sectors" responsible for individual areas of airspace, and flights are "handed off" from frequency to frequency as they progress from sector to sector. Frequencies are further divided into Low Altitude Sectors, handling aircraft up to 18,000 feet, and High Altitude Sectors, controlling aircraft at or above 18,000 feet.

APPROACH CONTROL provides the same services as Departure Control, only in reverse, guiding aircraft from the enroute phase of flight into the airport terminal area.

Many other radio facilities exist to assist and augment aircraft:

FLIGHT WATCH opens and closes flight plans for aircraft already in the air, provides up-to-date route weather information for airborne airplanes and emergency direction finding assistance for pilots who are disoriented or unsure of their positions. Flight Watch is not a controlling agency, simply a resource for all airborne pilots and operates nationwide on 122.0 MHz. Additionally, each Center maintains high-altitude "discrete" Flight Watch frequencies.

AIRPORT TERMINAL INFORMATION SERVICE frequencies broadcast recorded airport weather for landing and departing flights, which is updated hourly or when conditions warrant. This frequency relieves controllers from spending valuable radio air time repeating common information to aircraft. Look for ATIS broadcasts between 108 - 118 MHz.

UNICOM is where aircraft at uncontrolled (non-Tower) airports talk to each other, advising of position and intentions at the airfield. Unicom might be manned by ground personnel who provide advisories (current runway in use, wind, altimeter and reported traffic information) but these are not controllers and the final separation responsibility remains with the pilot. Unicoms operate between 120 - 124 MHz.

MULTICOM's are air to air frequencies over which pilots may coordinate with each other for purposes of formation flying or safety of flight advisories. They are located between 121 - 124 MHz.

Airlines maintain their own ARINC (say "air-ink") frequencies to pass company

This Air Resorts Convair 440 rolling on the taxiway is in contact with Ground Control until handoff to the Tower once in the run-up area.

messages, maintenance, fuel, and cargo information, as well as destination weather. These frequencies can be found between 128.800 - 132.000 MHz. In addition, AIRLINE GROUND SUPPORT frequencies carry two-way communications regarding aircraft handling, cargo, baggage, security and loading information to and from ground crews. Look for them between 460 - 465 MHz and 856 - 866 MHz.

Two frequencies are utilized for emergency locator beacons, which are designed to alert controllers to downed aircraft. 121.5 and 243.0 MHz, known respectively as "Emergency" and "Guard," can be monitored for the distinctive whoop of ELT's. Search and rescue operations take place primarily on 123.1 MHz, which serves as the primary voice frequency. 122.9 is utilized for search and rescue training exercises.

Sailplanes and balloons also communicate on the aviation band. Transmissions among these aircraft and to and from chase crews can be heard on frequencies between 122-124 MHz.

Military aircraft operate between 225-400 MHz where they can be heard conducting air to air "dogfighting," simulated and actual missile launches, aircraft carrier launches and recoveries, anti-submarine warfare training and much more. In addition, all civilian ARTCC's and Approach/Departure facilities maintain "parent" frequencies in the UHF military band to communicate with military aircraft.

All aircraft communications on both the 108-137 MHz and 225-400 MHz bands are in AM mode. Some scanners default to FM within the 225-400 MHz band, making aircraft transmissions unintelligible. Check your scanner specifications.

Communications can be cryptic and sentences are often spoken quickly. The pace and phrasing of transmissions ensure that frequencies are not tied up for any length of time. Seconds can be critical in controlling aircraft and instructions must get through.

All aircraft, civilian or military, must be on IFR (Instrument Flight Rules) flight plans above 18,000 feet, which makes it mandatory for them to be in radio contact with a controller. In addition, many airports have Terminal Control Areas (TCA's) or Airport Radar Service Areas (ARSA's) where pilots must be in radio contact with Approach/Departure control in order to enter or depart the confines.

Aircraft radar transponders work in concert with ground based electronic "interrogators" to display targets on controller's radar, often with altitude and speed information also shown. Controllers are thereby able to safely separate and regulate aircraft under their control by monitoring the information given on radar displays.

Aviation monitoring is a vast field, encompassing all aircraft from civilian, corporate, and commercial, to military and experimental. Part of its attraction results from the fact that aircraft operate in that tenuous medium called atmosphere. When a problem arises with an airplane, bringing it to earth safely can be a frightening trip.

As an aircraft monitor, you will hear the mundane and the exciting, often within the space of a few hours' listening. The routine can very quickly become a full-blown emergency, engaging pilots, controllers and company maintenance personnel, and tying up frequencies. Communications can be sparse during an emergency, with pilots finding little time to communicate while dealing with critical situations.

At other times, when the emergency condition is not life-or-death serious, communications may be constant as crews work to resolve the situation.

The weather is a great factor in communications. Clear weather, by far the best for flight crews, provides for smooth communications. Bad weather spawns increased

transmissions as pilots jockey for the smoothest flying altitude and request turns away from threatening weather. The existence of any type of poor weather makes the controller's job just a bit more difficult and illustrates the need for good two way communications between ground and air.

Flying is never dull. Though at first you might be daunted by the terminology and the seeming complexity of aircraft operations, a quick trip to the library can set you up with a wealth of books on flying that will clear up some of the fog. There is always something different and exciting to hear on the aviation bands.

Helicopter Seven Alpha Juliett moments from "skids down." Look for airport helo operations on Tower frequencies.

COMMON NATIONWIDE AVIATION FREQUENCIES

118.0 - 121.4	Air Traffic Control
118.375	Federal Aviation Administration (FAA)
118.575	FAA
118.925	US Forestry Service (USFS)
118.95	USFS
119.95	USFS
119.975	USFS
121.5	Emergency Locator Transmitters (ELT)
121.6 - 121.9	Ground Control
121.6	Ground Control
121.65	Ground Control
121.7	Ground Control
121.75	Ground Control
121.8	Ground Control
121.85	Ground Control
121.9	Ground Control
121.95	Flight Schools
121.975	FSS
122.0	FSS - Nationwide Flight Watch Freq
122.05	FSS
122.1	FSS
122.15	FSS
122.2	FSS
122.3	FSS

122.35	FSS
122.4	FSS
122.5	FSS
122.6	FSS
122.7	FSS
122.725	Unicom
122.75	Unicom
122.8	Unicom
122.85	Multicom - Air to Air
122.9	Search and Rescue
122.925	Multicom
122.95	Unicom
122.975	Unicom
123.0	Unicom
123.025	Helicopters/Heliports
123.050	Helicopters/Police Aircraft
123.075	Helicopters
123.1	Search and Rescue
123.2	Flight Test
123.225	Flight Test
123.3	Flight Test and Instruction
123.4	Multicom, Flight Test and Instruction
123.425	Flight Test
123.45	Multicom/Air to Air
123.5	Multicom
123.6	Airport Advisory Service
123.675 - 128.8	Air Traffic Control
126.2	Military Airport Towers VHF
128.875	ARINC
128.9	ARINC
129.25	Southwest Airlines ARINC
129.3	ARINC
129.5	ARINC
129.9	Foreign Carriers ARINC
130.0	ARINC
130.15	American Airlines ARINC
130.25	ARINC
130.275	ARINC
130.3	ARINC
130.45	ARINC
130.8	ARINC
131.050	ARINC
131.075	United Airlines ARINC
131.2	ARINC
131.5	ARINC
131.625	ARINC
131.925	ARINC

132.025 - 137.00	Air Traffic Control
135.85	FAA "Flight Check" Jets
135.95	FAA "Flight Check" Jets
172.150	FAA Inspectors
172.825	FAA
172.875	FAA
172.9	FAA
172.925	FAA
172.950	FAA
172.975	FAA

The Tower controls all air traffic within five miles and three thousand feet of an airport.

BUSINESS RADIO

Automobiles To Zoos

Someone once told me that everything that isn't police, fire, medical, aviation, rail roads, military or federal is classified as business radio.

The sheer amount of two-way radio traffic on the airwaves each day is staggering. Everyone from the power and water company to the construction crew holding up traffic on Main Street to the local zoo uses a radio to coordinate activities, chat and occasionally talk about business. Some of these communications are worthless as far as excitement content, but some are extremely entertaining and worthwhile.

You want examples? No problem....when the power goes out and I'm left stumbling around in the dark, I know enough to grab my handheld scanner and punch up the local power company frequency. Within minutes I usually have a pretty good idea what happened and how long until the juice starts flowing again.

When city crews are jackhammering the street to pieces, I can listen in and find out why they are disrupting my peaceful day.

Recently an escaped tiger at the zoo led park rangers on a wild safari which I monitored from the safety of my home scanner. Zoo frequencies from security to maintenance were active.

Private investigators, security services, attorneys, banks, cable television, department stores, malls, disposal services, hotels and motels, restaurants, racetracks, taxis and trucking, construction and electronics companies and even mortuaries are just a scanner switch away.

SERVICES ON THE BUSINESS BANDS

Construction Companies

Grouped under this heading are all construction related businesses from the guys raising the walls on a set of tract homes to electrical, plumbing, heating and air conditioning crews.

These frequencies are always busy with all types of communications relating to construction. Base stations at the home office calling crews in the field to discuss bids, tactics, complaints, problems, materials needed or mislaid. Workers at job sites coordinating building plans, maneuvering heavy equipment, directing traffic around street work sites. Electrical, plumbing, heating and air conditioning employees being dispatched to repair jobs.

I found the most use of a construction company's frequency one day while sitting in a long line of vehicles waiting for traffic to move on a street that had been closed down to one lane by workers. Monitoring the handheld radios of the flagmen, I was able

to determine how long the wait was going to be....so long that I ended up taking a side street around to save gas!

Another good recent example is an extensive rework of the street on which I live, including the laying of new water pipes. By monitoring construction frequencies of the companies involved, I knew when our water service would be shut off and when it would be restored, how long the work was estimated to take and all of the problems encountered along the way.

Utilities

Just as you suspected, utilities comprise your power, water, and gas companies, and we can even throw cable television suppliers in there, also. When service of any one is interrupted, a quick check of the relevant frequency usually tells the tale of what's gone wrong.

Pacific Bell field representatives operate in the 152 MHz band and can be heard talking with base and other crews.

Dispatching of units to service requests, coordination between employees in the field, service adjustments and shutoffs, and meter readers can all be heard.

All utility services maintain on-call crews who are available after business hours, on weekends and holidays to respond to emergency service requests. Late one night a transformer on a power pole exploded, sending sparks and blue-white light in all directions. After a call to the power company I monitored their dispatch frequency and not only found out when an on-call crew would be responding, but what the problem was, what was needed to fix it and how long repairs would take.

Utility company monitoring can be extremely informative, more so in times of emergency — floods, fires, accidents, storms — when these services are threatened.

Medical and Health Services

We talked in another chapter about hospitals operating paging services for their staff. In addition, security and maintenance also use the business bands to communicate, as do certain personnel on staff. A hospital is a large place and an Administrator, for instance, walking the halls might need to radio information back to his office on the top floor. The two-way radio is an excellent way of keeping in contact. Clinics, outpatient facilities and urgent care locations often use radios to coordinate their efforts, also.

Though not common, you will occasionally find private transport ambulances using the business bands. Medicine delivery services, as well as health appliance delivery also operate here.

Transportation Services

Trucking companies, towing services, furniture delivery trucks, florists, disposal services, taxis...anything on wheels that belongs to a business can be heard on your scanner. Land transportation is second only to sea transport in the business of moving goods from one point to another. You will hear constant communications within the business bands, especially on the new 800 megahertz frequencies now opening up.

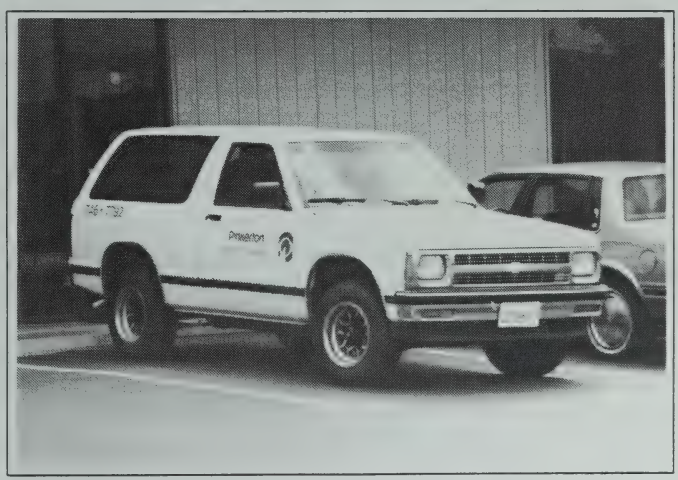
As an example of what you can hear, I searched through the business bands in my area and here are some of the transportation services I came across: a cement company coordinating its trucks into and out of the loading bays, heavy equipment being dispatched to job sites, the local trash disposal company collecting refuse, the driver of a florist delivery vehicle calling in to base for directions to an address, the rapid fire transmissions of a taxi dispatcher as he directed cab after cab to pick-up sites, a plumbing company discussing availability of replacement parts, an airport service shuttle calling clear from his last run...

I discovered some decidedly odd businesses on the air which resulted in some strange transmissions, like the woman dispatching a repairman to look at complaints of a leaking washer and dryer unit. Then there was the mortuary drivers advising base when they arrived and departed from different cemeteries and the two fellows talking about the positioning of the camera boats (which probably had to do with the America's Cup races taking place.)

Taxi's can be found in their own band located between 152.270 - 152.480. These will be base unit transmissions; look five MegaHertz higher (within the 157.530 - 157.710 MHz area) for mobile units. An example: King Cabs' dispatcher transmits on 152.300. The drivers will be heard responding on 157.300. Rival companies often monitor each other's dispatchers and race to undercut the other guy's fares. This results in some interesting radio conversations.

Security Services

Private security agencies are licensed for operation in the business bands and they can be heard patrolling malls, shopping centers, businesses, construction sites, office buildings, parks and private festivities. Some security services only operate on their frequency in the evenings. During the day, other businesses use the frequency for communications, so don't give up if you can't tune these services right away. Try listening at night and on weekends.



Security services come in many sizes and so do their vehicles. This one has no external communications anteena, but guards carry handhelds.

Armored cars are always interesting listening. They can be heard making radio checks in to their bases and receiving special dispatches.

Mall security is popular listening when you're shopping. Shopping malls have seen a great upswing in crime of late and have increased security to defeat it. Guards, plainclothes loss prevention specialists, camera monitors, lost and found, information booths and missing children booths can all be monitored.

WHERE TO LOOK

27.430 - 27.530
30.580 - 30.820
30.840 - 31.980
33.000 - 33.450
37.450 - 38.000
42.960 - 44.600
150.800 - 151.980
152.000 - 153.000
154.460 - 154.650
156.000 - 156.250
157.400 - 159.000
159.495 - 161.000
162.000 - 174.000
220.000 - 222.000
450.000 - 454.000
454.000 - 470.000
806.000 - 824.000
851.000 - 869.000
896.000 - 901.000
935.000 - 940.000

As you can see from this list, business frequencies pop up all over the scanner bands, sometimes shoehorned in between other services. How can you narrow down the search if you're trying to find a specific business's frequency? Take a stroll with me...

WHO'S WHO AND WHERE'S WHERE

Not too long ago I was searching for a local security service's operating frequency. I had no idea where they might be on the scanner bands, but I did know that security services are classed as businesses and given frequencies in the business band.

First of all, I checked the local telephone book yellow pages which displayed an ad for the security service saying, "radio dispatched." Now that I had confirmed that radios were actually used, I needed to find out what kind. Strolling through a mall complex, I was able to walk past a couple of guards close enough to get a fairly good look at their handheld radios. The brand name wasn't really important, but the antenna was.

Gene Hughes, editor of POLICE CALL, has a great section in the front of his frequency directory that shows antennas used for different bands. The length varies with the band. Short, stubby antennas are often connected to radios that transmit in the UHF range. Short, slim antennas are usually 800 MHz. Long whips are VHF-Low band. Medium sized are VHF.

The guard's handheld radio sported a short, stubby antenna. UHF. I was in the ballpark. At this point a frequency counter would have helped immensely and made the job a snap, but I didn't have one, so I went about it the old fashioned way — I searched.

Checking the list above, you can see that 450 - 454 and 454 - 470 MHz are the two main UHF business bands. Within those bands are areas which I have come to designate, through experience, as belonging to security services. This is the time when knowing the bands really helps the hunt.

My targets became 460 - 470 and 151 - 152 MHz. It took days and a good amount of listening, but eventually I found what I was looking for on 461.825 MHz. Anytime you come up with a possible frequency belonging to the service you're looking for, spend time listening to the transmissions. See if you can identify place names, locations, streets, anything to confirm who you're hearing.

Frequency directories help also, so always check those first. Remember that no frequency is impossible to find, it just takes work.

EVERYONE'S BUSINESS

You won't need to search long to find business frequencies. They are all over the place, carrying the radio traffic from the smallest two-bit outfit to the largest contractor. Take time to listen on each active frequency you find, noting radio call signs, type of transmissions, what's being talked about, times of activity. Sooner or later, you will be able to define who you're hearing. I'll admit that it might be later rather than sooner, but the hunt is the most fun.

You never know who you'll tune in on the business bands. Companies that you never knew had radios will be heard. I walked into a bottled water company's offices and saw a handheld radio on the desk. Across the parking lot, in another office of the same company sat another handheld radio. I am still trying to find their frequency. Don't rule out just asking an employee for the numbers, they might just oblige you!

FEDERAL MONITORING

From ATF To The White House

♦

Federal communications exist as one of the more specialized facets of scanner monitoring. The federal bands are not the place to hear police/fire type non-stop transmissions. More often than not, the bands are quiet and a monitor casually passing through the frequencies is bound to give up for what they deduce as lack of action. However, with patience and a dash of persistence, federal monitoring can be very rewarding.

Our government is a maze of departments, divisions and commissions, most of whom use radio to coordinate their efforts. A quick look through the telephone book government pages will reveal those agencies with offices in your area. Generally speaking, your chances of hearing the communications of a particular agency are directly related to the proximity of that agency's field offices to your location.

WHAT CAN I HEAR?

Federal law enforcement agencies occupy a large portion of the federal bands. Federal Bureau of Investigation, Drug Enforcement Agency, Central Intelligence Agency, United States Customs Service and Bureau of Alcohol, Tobacco and Firearms all conduct undercover surveillance operations on frequencies within the 162 - 170 and 415 - 420 MHz bands.

U.S. Customs routinely engages in undercover operations at airports and ports of entry in the United States, in close cooperation with Drug Enforcement Administration and Bureau of Alcohol, Tobacco and Firearms agents. Customs is concerned with halting the over-border flow of all types of contraband, however our country's large narcotics problem leads to many buy/bust missions and surveillance of drug dealers and users.

A U.S. Customs Service MK117. The Customs pilot told me that "love this helicopter for its stealth and reliability."

The vast borders of the United States are protected

from illegal entry by the U.S. Immigration and Naturalization Service (Border Patrol) who can be heard maintaining border checkpoints and crossings and tracking illegal aliens for deportation. Aircraft are often heard patrolling in coordination with ground units.

The U.S. Fish and Wildlife Service, whose jurisdiction includes over 90 million acres of land, enforces fish and game laws through the use of vehicle and animal tracking devices, transmitters, surveillance cameras and listening devices.

The U.S. Department of Agriculture (USDA) maintains a forest fire fighting contingent responsible for national forests and grasslands throughout the country. Tactical, Command, Logistics and Air Attack Fire fighting operations can be heard within the 168 - 170 MHz and 414 - 416 MHz bands. Operations are often carried out in cooperation with such agencies as the Department of the Interior, Bureau of Land Management and state-specific agencies such as the California Department of Forestry.

Some of the other agencies to be heard include the Federal Aviation Administration (FAA) which maintains the country's aeronautical navigation aids through the use of "Flight Check" jet aircraft and ground based maintenance personnel. The FAA also licenses pilots, mechanics and air traffic controllers, runs air traffic control facilities, and investigates air accidents along with the National Transportation Safety Board.

The U.S. Postal Service coordinates its postal inspectors via radio, as does the U.S. Attorney's Office and the Departments of Commerce and Labor.

White House presidential communications, overseen by the White House Communications Agency (WHCA), provides communications and telephone patches to and from Air Force One and Two. They also maintain communications with the U.S. Secret Service whose agents watch over the Camp David compound, White House, and Vice President's quarters, and provide escorts for visiting dignitaries and heads of state. Coordination with other federal agencies is the responsibility of WHCA.

Federal monitors throughout the nation monitor 162.6875, 171.2875, 407.85 and 415.70 for Air Force One and Two up- and down-link telephone calls. Generally these communications occur in the clear, with no voice protection and offer a fascinating look at the nation's top leaders in action.

From the FBI to the Bureau of Engraving and Printing, there is no limit to the federal agencies that can be monitored. The allure of listening to supposedly "secret" government agencies is often tempered after the scanner owner's discovery of the tenuous nature of many federal frequencies, the habit of "frequency switching" during operations, channels that are active for a short time and then silent for months, and scrambling.

FINDING FEDERAL FREQS

Those that hang in and listen find that federal listening requires patience, tenacity, and a bit of detective work. The government doesn't always make it easy to monitor their activities, and they do not publish frequency lists. Nevertheless, hearing them is just a matter of switching on the scanner and searching with persistence.

The best method for coming across federal frequencies is to designate a portion of the band and monitor it. For instance, 418 - 419 MHz is a popular area for DEA and Bureau of Alcohol, Tobacco and Firearms (BATF) radio transmissions. I use the search mode of my scanner to continuously search the frequencies within this range. Take a

week or more to find out what action is occurring in your area. Don't give up easily, the frequencies will become active, but it might take awhile.

Six months ago I heard an undercover operation on a DEA frequency that went on for three days. I haven't heard activity on that frequency since then. I am certain it will be used again, I just don't know when. Half the fun of federal monitoring is coming across activity on previously quiet frequencies.

SCRAMBLING

Many federal communications, especially those of law enforcement or sensitive agencies, utilize voice scrambling, sometimes called DES (Digital Encryption System) or DVP (Digital Voice Protection.) Voice scrambling protects transmissions from being understood by unauthorized listeners. It often sounds like rushing static or an open carrier on the frequency, which cannot be defeated by raising the squelch control.

Regardless of this, I find 90 percent of federal communications taking place "in the clear," without the benefit of voice scrambling. The complexity of the equipment often causes failures that disrupts the ability of agents to talk to each other. Therefore, most of the voice scrambling done in the federal bands is "routine sensitive" information such as suspect or agent names and locations.

When the "street by street" surveillance takes place, transmissions revert to clear voice. Though these agencies know they can easily be overheard, the need for clearly understood transmissions between agents often outweighs the hassle of using encryption.

CHANNEL DESIGNATIONS

Most federal agencies use numbers or phonetic letters to designate their frequencies. This can make it difficult to follow communications that switch channels. "Unit 441, switch to Charlie Three" leaves the monitor hanging when the frequency numbers for Charlie Three are not known. Searching a one megahertz block above and below the frequency (418.625 = 417-420 MHz) will often yield the same agents on another frequency...Charlie Three...if you are lucky!

Federal monitoring is very much a "hands-on" specialty. It requires that a monitor spend time getting to know the federal bands and the agencies using them. Many frequencies, such as the common ones belonging to the FBI and DEA have been published in commercially available directories. The arcane channels, such as those used for car to car surveillance and undercover operations, are more difficult to find. These are the frequencies that must be hunted down and provide the most satisfaction when found.

You don't need experience with scanners to be successful at hearing transmissions on the federal bands, you just need tenacity and desire. You'll be surprised at what you can hear and even more surprised with what you learn.

BUREAU OF PRISONS

Ops	F1	170.875
Ops	F2	170.925
Emergency	F3	179.650
Repeater T2/3/4/5		163.8125/163.200
Court Security 1		170.850
Court Security 2		170.750

FEDERAL AVIATION ADMINISTRATION

Facilities 1	172.925
Facilities 2	172.950
Facilities 3	172.975
Facilities 4	172.850
Facilities 5	172.875
Facilities 6	172.900
Facilities 7	172.825
Facilities 8	172.125
Facilities 9	172.150
Facilities 10	172.175
Facilities 11	166.175

UNITED STATES MARSHAL'S SERVICE

Ops Rep	F1	163.8125/163.200 I/O
Ops Direct	F2	163.200
Canada/Mexico	F3	163.8125/164.600 I/O
Ops Direct	F4	164.600
Metro Rep	F5	170.850/162.7875 I/O
IMetro Direct	F6	162.7875
Intercity Rep	F7	170.850/162.7875 I/O
Intercity	F8	162.7875
Prisons 1	F9	170.875
Prisons 2	F10	170.925
Ops Rep	F11	163.8125/163.200 (Also Ops Rep F12/13)
Federal Courts Sec		170.750
Federal Courts Sec		170/850

UNITED STATES CUSTOMS

165.2375	Alpha 1/2
166.4625	Alpha 3
166.5875	Alpha 4
164.325	Alpha 5
163.125	Alpha 6
165.7375	Blue One West (Bravo 3)
166.2875	F8 Liaison
166.4375	Customs Input
165.4375	Bravo 1 Tactical
164.200	Tactical
234.6	Aircraft
238.4	Aircraft
253.9	Aircraft
254.2	Aircraft
260.8	Aircraft
282.425	Blue One West
381.8	Blue One East

Customs unknowns

162.825	171.250
163.000	255.6
163.225	269.3
163.675	281.4
164.100	297.2
165.2875	299.2
165.3375	353.9
165.5375	354.2
165.6875	381.5
165.9125	418.225
165.950	
166.200	
166.400	
168.630	
169.535	

DRUG ENFORCEMENT ADMINISTRATION

Ops Rep	F1	416.050
Ops Rep	F2	416.325
Ops Direct	F3	418.750
Ops Direct	F4	418.675
Ops Rep	F5	415.600/418.825 I/O
Ops Rep	F6	416.200/418.950 I/O
Ops Rep	F7	417.025/418.975 I/O
Ops Tac	F8	418.175
Coast Guard Coord		418.575
Government Coord		418.050
Air/Ground Tac		418.500
Tactical		418.700
Tactical		418.800

DEA Unknowns

163.5375	170.900
164.825	171.250
165.2375	171.450
165.2875	171.650
165.4125	172.000
165.5125	172.050
165.5675	172.200
166.4625	172.700
169.200	172.575
170.875	

BUREAU OF ALCOHOL, TOBACCO AND FIREARMS

Ops Direct	A1	165.2875
Ops Tac	A2	166.5375
Ops Rep	A3	166.5375/165.2875 I/O
Treasury Cmn	A4	166.4625
Tac 1	A5	165.9125
Tac 2 aid	A6	173.8875
Tac 3	A7	168.0000
Arson Invest	A8	166.5375/173.8875 I/O
Surveillance		166.2875
Surveillance		170.4125
ATF IAD		407.1500
Treasury IAD		407.1500

FEDERAL BUREAU OF INVESTIGATION

Nationwide Cmn	A4	167.5625
FBI-SWAT	A7	167.5375/163.8625 I/O
Nationwide Cmn	B4	167.5625
FBI-SWAT	B7	167.5375/163.8625 I/O
Alpha 1 - Surveillance		167.3875
Alpha 2 - Surveillance		167.6875
Alpha 3 - Surveillance		167.2125
Alpha 4 - Car to Car		167.5625
Alpha 5 - Surveillance		167.2625
Alpha 6 - Tactical		163.8625
Alpha 7 - Surveillance		167.4625
Bravo 1 - Surveillance		167.3875
Bravo 2 - Area Repeater		164.250
Bravo 3 - Area Repeater		164.350
Bravo 4 - Area Repeater		164.425
Bravo 5 - Area Repeater		165.5625
Bravo 6 - Primary Dispatch		162.7875

These frequencies have been compiled from various sources and from my own personal monitoring. Channel designations and uses may vary nationwide.

MONITORING THE PRESIDENT

"CROWN, AIR FORCE ONE, AIR FORCE ONE, how copy on nationwide?" Nothing will wake you up quite so fast as hearing these words blast out of your scanner's speaker. They brought me to full alert one rainy evening in February as I was scanning through a bank of preprogrammed frequencies belonging to the Secret Service.

President George Bush was enroute to San Diego for an overnight campaign stop and though the Naval airfield where he would be landing was over thirty miles away, I took a chance and scanned the relevant frequencies for activity.

Ten minutes before the Presidential aircraft was scheduled to touch down, 415.700 MHz, the UHF telephone patch frequency, came alive. Most monitors know of the existence of this frequency, over which the crew of Air Force One makes contact with Crown, the White House Communications Agency to arrange and conduct telephone patches. What I had always heard was that this frequency carried the aircraft side of the conversation and 407.850 MHz carried the ground portion. If you weren't in range of one of the many ground stations located in the US that carry Crown communications, you would miss out on half of the transmission.

Lo and behold, I had both sides of the conversation loud and clear on 415.700 MHz, which splashed the split frequency theory down, at least on this flight.

"AIR FORCE ONE, CROWN copies you, go ahead, sir." "CROWN, AIR FORCE ONE seven minutes from landing, request phone patch from Miss Smith to Mike Smith at the following number..." (paraphrased from actual reception).

A few code names were thrown around, including ARDENT FOX, which I took to be the code name for the campaign mission the President was on. All communications were unscrambled in Narrow Band FM mode on 415.700 MHz.

While the phone patch was taking place on UHF, other frequencies were locking up a second scanner. I had set this radio up to cover the NIGHTWATCH secure VIP communications network (also known as Wideband, Whiskey Bravo, Orderwire, Combat Cinders, Autovon and Alpha Bravo.) In rapid succession, the scanner locked up on 366.000, 336.800 and 397.050. No voice, just a powerful open frequency. Folks in the know say the open frequency means to stand by for voice traffic. I did hear a phone patch on 366.0, but it must have been in Lower/Upper Sideband mode, because I couldn't clear it up.

397.050 carried direct communications from the pilot of Air Force One to Crown about time on the ground, time off the ground, fuel, etc.

Some of the Secret Service channels were also active, but most of it was secure voice (DVP - Digital Voice Protection or scrambled) and unintelligible. Regardless, the frequencies were hopping all the way to touchdown. There was very little drift and all communications continued loud and clear even after the aircraft was on the ground (thirty miles and quite a few hills away.) That attests to the power of the transmitter aboard Air Force One.

Monitoring the President is actually not difficult at all, but it requires patience, quick hands and lots of curiosity.

AIR FORCE ONE

The Presidential aircraft, code name Air Force One when the President is aboard, SAM 27000 when he is not, is a popular target of federal monitors. The huge Boeing is outfitted with the latest in sophisticated communications gear, including cryptography equipment to scramble any and all transmissions.

Regardless, Air Force One continues to be heard "in the clear" all over the country. The following frequencies have been reported for telephone patch traffic to and from the aircraft in the United States:

415.700	Air Force One Downlink ("Nationwide", "Foxtrot")
408.750	Air Force One Uplink ("Nationwide", "Echo")
162.6875	VIP Aircraft Uplink ("Yankee")
171.2875	VIP Aircraft Downlink ("Zulu")

The last two frequencies are reported to be used for phone patches to and from VIP aircraft such as the Secretary of State, Secretary of Defense, Foreign Heads of State, etc. The Vice President's aircraft, Air Force Two, is often heard here, as well as on the two main Air Force One frequencies.

The United States Marine Corps maintains the Presidential helicopter (known as Marine One when the President is aboard), which can often be heard transmitting on the following frequencies:

46.750
46.700
46.800
122.850 ("Victor")

The 46 Megahertz frequencies are subject to low band "skip" and transmissions are often audible thousands of miles from the point of origin. Keep a close watch on these frequencies for helicopter operations.

UHF frequencies belonging to the NIGHTWATCH (or Wideband) system see heavy use by Air Force One and VIP aircraft. The following channels have been reported in use:

246.950
305.550
322.750
326.000
336.800
345.500
366.000
382.350
390.000
397.050

These frequencies can handle traffic in WBFM, NBFM, AM, Lower and Upper Sideband. Power output varies, but has been reported as capable of one kilowatt. In addition to voice, scrambled communications occur on these frequencies, as do data transmissions.

Check the NIGHTWATCH system often for activity. I have heard VIP aircraft be longing to the Secretary of State and others operating here. Keep a close watch on press reports for information pertaining to planned visits of dignitaries to your area. Then tune in and see what happens!

UNITED STATES SECRET SERVICE

The job of protecting the President, Vice-President, and high-ranking United States officials belongs to the men and women of the Secret Service. These are the people in the dark suits and sunglasses you see following the VIP's around with handheld radios. Their jobs are vital and monitoring them is a great way to keep track of the President and his entourage when they come through your town.

The following frequencies are compiled from various sources and from my own personal monitoring experiences. Channel names change, as does channel usage.

BAKER	165.7875	President & VIP Protection
CHARLIE	165.3750	Command Post Primary, nationwide
DELTA	169.925	WHCA Vans & Phone Patches
GOLF/ROMEO	166.400	Input Channel for 166.4625
HOTEL	166.2125	President & VIP Protection
INDIA	407.925	Treasury Security Force
JULIETT	170.000	Camp David Pagers
KILO	167.825	WHCA Staff
LIMA	168.7875	WHCA Staff
MIKE	165.2125	Foreign & Domestic Dignitaries Escort
OSCAR	166.8875	President's Limo & Executive Family

PAPA	164.400	President & VIP Protection
QUEBEC	166.700	WHCA Staff
SIERRA/ALPHA	166.5125	Escort/Security/Protection/Pagers
TANGO	164.650	President & VIP Protection
UNIFORM	165.0875	
VICTOR	164.100	President & VIP Protection
WHISKY/NOV.	167.025	Pagers/WHCA Staff
X-RAY	166.4625	Treasury Interagency Common
N/A	407.825	Body Microphones
N/A	407.875	Body Microphones

The Treasury Service Security Force is reported to be using the following channels:

BLACK	415.675	Uniformed Division
BROWN	415.650	Foreign Missions
ORANGE	414.950	Uniformed Division
RED	415.975	Foreign Missions
VIOLET	415.875	Training
YELLOW	414.675	WHCA

Much of the communications traffic passed on these frequencies is encrypted or scrambled. DVP is prevalent and in some cases, no clear voice is used at all. The Secret Service knows that their frequencies are audible to anyone with a little intelligence and a scanner. Protecting the President is a big job and all measures are used to see to his safety.

Clear voice transmissions do pop up when you least expect them, so don't discount any of these channels during a Presidential visit. Also, cellular telephones are used heavily by Secret Service agents, so scan the 869 - 896 MHz range of frequencies also.

IF YOU'RE EVER IN D.C....

Try out these frequencies, which should be very active when the President is around.

Camp David:

Helicopter Pad	375.000
Secret Service	32.230
Pagers	170.000

Andrews Air Force Base, Camp Springs, Maryland:

Approach/Departure	120.400
	125.650
	269.500
	294.500

Tower	118.400
	236.600
	289.600
Ground	121.800
	275.800
Command Post	141.550
	378.100
	407.425
OSI	40.170
	40.190
Security	413.000
	413.275
	413.375
	163.4625
	163.4875
Fire	173.5875

Pentagon, Washington, D.C.:

Helicopter Pad	143.100
Naval Intelligence	140.600
Army	30.490
	32.530
	36.510
Mobile Phones	143.350

Bethesda National Naval Medical Center, Maryland:

Security	140.725
	41.830
Fire	140.725
	140.275
Ambulances	140.275
Disaster	142.225
	142.450
Link with Andrews	172.950
Medevac Helos	296.000

CRACKING THE CODES

Secret Service agents use codes almost as a second language when communicating, as do crew-members aboard Presidential or VIP aircraft. Understanding these codes can make the difference between a fruitful radio intercept and "I heard them, but I don't know what they were talking about."

These codes and abbreviations are compiled from various sources. Accuracy cannot be assured as codes change often or are reassigned.

ACROBAT	Andrews Air Force Base, Maryland
ANDY	Andrews Air Force Base, Maryland
AIR FORCE ONE	President's aircraft
AIR FORCE TWO	Vice President's aircraft
ARMY ONE	Army helo w/President aboard
ARMY TWO	Army helo w/Vice President aboard
BAMBOO	Presidential motorcade
BUCKEYE	Camp David, Maryland (also Cactus, Elm)
CROWN	White House Communications Agency
ELECTRIC	National Emergency Command Post Aircraft
EXECUTIVE ONE	President aboard non-military aircraft
EXECUTIVE TWO	Vice President aboard non-mil aircraft
FENCING MASTER	Secretary of the Treasury
FIREPLUG	Secretary of Labor
FLYING FISH	Secretary of the Interior
HOTSHOT	WHCA Duty Officer
MARINE ONE	Presidential Helicopter (Pres. aboard)
NIGHTHAWK	Marine helos without President/VP aboard
TIMBERWOLF	President George Bush
PIVOT	Helo pad, Bethesda Naval Hospital
PLAYGROUND	Helo pad, Pentagon
SAM	Special Air Mission
SAM 86971	Secretary of State's aircraft
SAM 86972	National Security Advisor's aircraft
SUNBURN	Senator Ted Kennedy
SUPERVISOR	Vice President J. Danforth Quayle
TRANQUILITY	First Lady Barbara Bush
VENUS	SAM aircraft without VIP aboard

Disaster Codes

BENT SPEAR	Significant nuclear accident
BROKEN ARROW	Damaged nuclear weapon
COVERED WAGON	Confirmed hostile act
DULL SWORD	Nuclear incident
FADED GIANT	Radiological incident/accident
HELPING HAND	Hostile act threat

PUTTING IT ALL TOGETHER

The following morning, when Air Force One readied for departure from San Diego, I again heard powerful open frequencies fifteen minutes before takeoff on 366.0, 336.8, 397.05. 415.700 MHz carried phone patch voice traffic from a senator aboard Air Force One. Communications remained loud and clear for approximately twenty minutes after takeoff. Quite long enough to say that I had logged Air Force One.

Though I didn't actually hear the President, who was presumably too busy to bother with telephone calls, I did tap into communications few can say they have heard. Your scanner can take you places you cannot dream of...even aboard the President's airplane.

MILITARY COMMUNICATIONS

Armed Forces Monitoring

♦

I'm fifteen miles away and I can still hear it clearly; the muffled, window-rattling concussions of Marine Corps artillery. MCAS Camp Pendleton, California is home to the First Marine Division, First Marine Amphibious Force, Third Marine Aircraft Wing and a host of heavy helicopter squadrons. From this base fly AV-8B Harrier jump jets, Huey and Sikorsky helicopters, and OV-10 Bronco observation aircraft.

Ground forces conduct simulated amphibious landings, fire massive artillery barrages on the maze of ranges and practice recon in the miles of hills that are Marine Corps territory.

My scanner is an audio window on the base. Low band frequencies come alive with range control directing artillery firings and marines coordinating field exercises. Security police, brig guards, fire, rescue and ambulance traffic, command, engineering and Navy/Marine Corps investigators, as well as base animal control and game wardens are active on VHF. Aircraft operations — fixed wing and helicopter — fill frequencies in the UHF 225 - 400 MHz band.

There is always action on base; days, nights and weekends. When the shuddering concussions shake the ground, travelling miles from the actual site of the firing, I know where to tune to find out who's conducting live fire operations today. When Marine Corps aircraft rumble low overhead, I tune them in on UHF.

Military monitoring is accessible to almost every scanner owner. 30 - 50 MHz, where low band military communications take place, 138 - 144 and 149 - 150.8 MHz on VHF are standard bands commonly available on general coverage scanners. The average monitor neglects these bands, looking for easier fare or channels with "action." The military bands are very active, they just require a little more work to hear.

Pull out a map of your area, and look for any military bases within about a fifty mile radius. If you don't have a map handy, try the government pages of your local telephone book. Make a list of the military facilities you find and the branch of the armed forces that operates each one. Now, slide a chair over to your scanner, make yourself comfortable and let's take a radio tour...

STARTING THE SEARCH - MILITARY RADIO BANDS

30.000 - 50.000 MHz

Military Low-Band handheld, pack, and vehicular radios use the following frequency ranges:

30.000 - 52.950 MHz "Low Band"
53.000 - 75.950 MHz "High Band"

Helmet-Mounted Radios (PRR-9's) are in the range 47.000 -57.000 MHz. Standard units come with one of their two channels set to 51.000 MHz normally. (Usually changed out by the using command, however). You may experience some audio cut-out of signals on a normal narrow-band scanner. It varies from scanner to scanner depending on how tight the narrow-band filters are. Lowering your squelch setting often helps communications to get through.

Modulation modes are often Wide Band FM, approximately 15 KHz deviation on channels spaced every 25 KHz. In the USA, use is mostly in the 30.000 - 79.950 MHz range, subject to avoiding interference with civilian communications. Communications conducted in AM mode have been heard.

Army and Marine Corps infantry units use frequencies within this band extensively, as do ships of the US Navy and Coast Guard. I have found much activity between 30 - 50 MHz, including infantry exercises, amphibious landings, Navy SEAL team operations, and air to ground bombing by military aircraft.

According to Jack Sullivan, author of the article *"Communications Eavesdropping on the Battlefield"* (MONITORING TIMES, July 1991), low band communications between 30 - 50 MHz were used heavily during Operation Desert Storm fighting in the Persian Gulf. Scanner monitors in the United States were able to intercept transmissions in the clear (unscrambled).

I regularly listen to low band communications from military bases thousands of miles away thanks to "skip," in which radio signals travel over long distances.

Technically, the military low band extends up to 87.975 MHz, just below the commercial FM broadcast band. Most military radios have the capability to use the entire band, however the activity is concentrated between 30 - 50 MHz. Bear in mind that transmissions are often Wideband FM and your scanner must be able to manually switch to this mode for clear reception.

138.000 - 144.000 and 149.000 - 150.8

Operating mostly in Narrow band FM, with occasional AM and Wideband FM transmissions, communications within these ranges include not only tactical, but military police, base traffic, guards, fire, ambulance, paramedics, weapons, brig, maintenance, motor pool, etc.

When looking for base non-tactical communications, your best bet is to scan these two bands. Most of what I listen to here uses Narrow band FM for transmitting. Ranges are usually five to fifty miles depending on your location, obstructions in the way of your antenna and atmospheric conditions.

225.000 - 400.000 MHz

This is the workhorse band of military aviation. All aircraft communications take place in AM mode. Air traffic control, air to air, aerial refueling, aviation weather, bombing ranges, tactical flight areas, carrier aviation, ship to ship and ship to aircraft - you name it, if it involves a military aircraft, it can be found somewhere within this range.

In addition, military satellite links such as Air Force AFSATCOM can be heard within the 243.000 - 245.000 range. Most activity is scrambled voice or data links, but

some clear voice gets through. Airborne Missile Launch Control Centers, Strategic Air Command Post Attack Command Control System, and Nightwatch VIP communications all occur within 225 - 400 MHz.

An Air Force C-5 Galaxy transport is a massive airplane and a massive catch if you hear one transmitting.

All armed forces can be heard using this band in a wide variety of modes from AM to WBFM. I would advise that you take one chunk of the spectrum at a time and scan it for activity. For instance, 225 - 227 MHz is a small enough portion of the band to work with. Scan it for a week and then move on to 227 - 229 MHz. Taking small portions allows a monitor to remain "on top" of anything that transmits. If you take too big a chunk — say 300 - 350 — you are defeating your purpose almost at the outset. You are liable to miss a transmission on 300 MHz while the scanner is searching up around 340.

Communications on this band are often sparse and it might take some time before you hear anything. Don't give up! I was convinced the first time I scanned this band that I wouldn't hear anything at all. It was four days of anguish before I logged an active frequency. Communications are there, but you will have to hunt for them.

BEST BETS - NATIONWIDE FREQUENCIES

When I was starting out in military monitoring I found a list of frequencies guaranteed as active anywhere in the country. These numbers became my guide and saved me from giving up early for lack of "action."

Each branch of the armed forces maintains common frequencies in use at facilities throughout the nation. In your search for active military channels, check these first:

United States Air Force

138.075	USAF Office of Special Investigations
138.175	USAF Office of Special Investigations
126.2	USAF Air Traffic Control Towers VHF
134.1	USAF Ground Controlled Approach VHF
131.8	USAF Air to Air over ocean/remote areas
130.55	USAF Air to Air over ocean/remote areas
128.95	USAF Air to Air over ocean/remote areas
239.8	USAF Pilot to Metro Weather
342.5	USAF Pilot to Metro Weather
344.6	USAF Pilot to Metro Weather

375.2	USAF Pilot to Metro Weather
243.0	USAF "Guard" Distress/Emergency UHF
121.5	USAF "Guard" Distress/Emergency VHF
282.8	USAF Search and Rescue
311.0	USAF Strategic Command Primary
321.0	USAF Strategic Command Secondary
322.8	USAF Strategic Command Air to Air
327.1	USAF Strategic Command Air Refueling
130.65	USAF Air Mobility Command
372.8	USAF Air Mobility Command
381.3	USAF Air Combat Command
376.1	USAF Air Combat Command
228.7	NORAD
233.6	NORAD
238.7	NORAD
273.4	NORAD
292.8	NORAD
318.4	NORAD
338.1	NORAD
364.2	NORAD

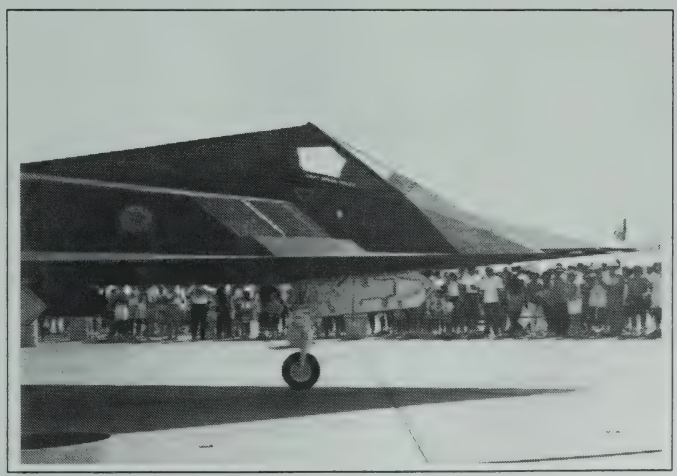
United States Navy/United States Marine Corps

140.075	USN NIS-Naval Investigative Service
140.650	USN NIS-Naval Investigative Service
40.530	USN Range Communications
40.790	USN Range Communications
142.000	USN Range Communications
142.050	USN Range Communications
149.490	USN Range Communications
141.100	USN/USMC Air Station Crash Crews
126.200	USN/USMC Air Traffic Control Towers VHF
134.100	USN/USMC Ground Controlled Approach
41.950	USN/USMC Air Traffic Control Towers
360.200	USN/USMC Air Traffic Control Towers UHF
277.800	USN Fleet Common
280.2	USN Fleet Common
255.3	USN Fleet Common
300.6	USN/USMC Training
231.3	USN Air Intercepts
254.6	USN/USMC Air Refueling
354.9	USN Air Combat Maneuvering

United States Army

413.425	USA CID Operations
412.900	USA CID Operations
406.975	USA CID Operations
36.710	USA Hazmat Escort
36.890	USA Hazmat Escort
148.650	USA MARS-Military Affiliate Radio System
30.100	USA Convoys
36.100	USA Convoys
40.900	USA Convoys
46.900	USA Convoys
49.700	USA EOD-Explosives Ordnance Disposal
49.800	USA EOD-Explosives Ordnance Disposal
49.900	USA EOD-Explosives Ordnance Disposal
32.100	USA Tactical Ops
34.100	USA Tactical Ops
38.900	USA Tactical Ops
40.100	USA Tactical Ops
40.500	USA Aeronautical Emergency/Distress
138.750	USA Search and Rescue Operations
126.200	USA Air Traffic Control Towers VHF

Our nation's soldiers train for war in peacetime at bases all across the country. Their communications encompass not only military exercises, aircraft operations and tactical transmissions, but the routine services common to us all —police, fire, medical, animal control, engineering, public works. Each military facility is designed as a city unto itself and monitoring base radio traffic can be an engrossing and fascinating task.



Even the F-117A Stealth fighter can be heard, but you'll have to hunt for this one; its transmissions are as elusive as its name.

I continue to find new frequencies in use at the bases around me. From low band up through UHF, frequencies come alive, sometimes intermittently and sometimes constantly. I keep an eye on the radio, television and newspapers for reports of military activities, maneuvers, and exercises. There is no end to the armed forces activity available to be scanned, but your search must be an ordered one. Know where to look, know when special military events take place (an excellent opportunity to catch new frequencies in use) and know how to keep a log of all you hear and where you hear it.

Don't neglect base "open houses," air shows or exercises open to the public. They are rare, but being on base is the best vantage point for finding frequencies. I've taken my handheld scanner on numerous expeditions onto bases for air shows and never been bothered. Security police and guards are usually more curious than anything else. Tact is the key word, though the Air Force Security Police Officer that stood on guard next to the F-117 Stealth fighter didn't seem to mind that I was furiously punching scanner buttons right under his nose, nor did the Chief Petty Officer who drove myself and a bus full of passengers across base. The military never rests and neither should a good military scanner monitor.

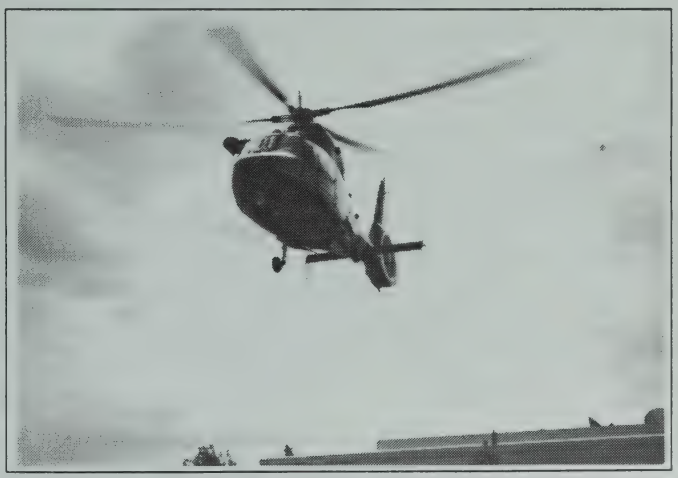
MARITIME SCANNING

High Seas Scanning

Men have gone down to the sea in ships almost since the beginning of time. The greatest sailors of history, the Phoenicians, began a tradition in 1200 B.C. that is carried out today all across the world's waters...the movement of bulk commodities and passengers by ship. Grain, coal, petroleum, automobiles, industrial machinery and electronic products, as well as people, use our nation's oceans and waterways in a mode of transportation second only to that of land.

In 1914, ships began to be outfitted with radiotelegraphy equipment, allowing Morse Code communications between boats and shore stations. This ability to communicate with land removed much of the distance that resulted when vessels sailed away on journeys of months, sometimes years, and relied on infrequent port calls to send messages.

The year 1922 saw the slow switch from radiotelegraphy (continuous wave or Morse Code) to radiotelephony (voice communications.) Today, Morse Code still sees use on the High Frequency (HF) bands between ships at sea and land stations, but a whole new world has been opened up through the use of VHF. Very High Frequency, due to the limits of its shorter range, is used mainly closer to shore. It is here, on the VHF band, that the scanner monitor will find the best of maritime scanning.



A U.S. Coast Guard HH-65 Dolphin rescue helicopter, wheels down and transitioning to the hover.

WHO WILL I HEAR?

The VHF maritime band extends from 156.000 to 162.000 MHz. Communications are conducted on ninety-nine simplex and duplex channels in FM mode.

As mentioned previously, VHF transmissions are short range, line of sight and see the most use near shore and on inland waterways, where distances between ships and shore stations are minimal.

Within the VHF marine band you will hear small craft such as yachts and sailboats, commercial and passenger carriers such as shipping lines and cruise ships, vessels and aircraft of the United States Coast Guard, Harbor Patrol boats, state and local government vessels, weather stations, ship to shore telephone traffic and communications in the vicinity of dams, locks, canals, lakes and rivers.

Strange things often pop up unexpectedly, like the time I listened to a fish-spotting aircraft give sailing directions to a group of off-shore fishermen. Or the time the Harbor Patrol worked for hours on releasing a beached whale back into the sea. Environmental communications are popular listening targets, as groups from Greenpeace to the Environmental Protection Agency track oil spills and hazardous waste.

United States Coast Guard frequencies are always active with status reports from ships and aircraft and working search and rescue cases.

MARITIME FREQUENCY GUIDE

Specific frequencies have been assigned numbered designators for identification and it is these designators that you will hear on the air when vessels or shore stations refer to frequencies.

Emergency

- Channel 16

Channel 16 is monitored by all vessels by law and is the place where distress and emergency transmissions are made. (See the frequency list at the end of this chapter for specific frequencies.)

Distress procedures are initiated when a ship is on fire, sinking, someone has been lost overboard or grave and imminent danger exists. Every vessel at sea is obliged to give priority to distress calls.

The procedure usually begins with a broadcast of "Mayday, Mayday, Mayday" followed by the call sign and boat name, location of the vessel and type of emergency. This call is repeated until someone answers, though it is not uncommon for vessels to try other frequencies for assistance if no reply is heard on Sixteen.

The Coast Guard maintains a twenty-four hour listening watch on Channel Sixteen and responds to distress calls. In addition, many Harbor Patrol and Lifeguard stations monitor this frequency.

Calling

- Channel 16

Channel 16 is also used for calling proposes. When one vessel wishes to contact another, the communications are initiated on Sixteen and then moved off to a working frequency. The Marine Operator who handles Ship to Shore Telephone calls often broadcasts on this frequency when wishing to contact a vessel for whom she holds traffic. In addition, vessels calling the Coast Guard do so here, as well as Coast Guard stations advising vessels of upcoming marine information broadcasts.

Intership Safety

- Channel 6

Channel Six is reserved for communicating navigation and weather warnings to other ships and for transmissions with US Coast Guard vessels and stations during search and rescue (SAR) operations.

Six is strictly a safety channel between ships and is not used for routine transmissions.

This fishing boat is liberally adorned with communications antennas. Listen for fishing operations in the 156 MHz band.

Navigation

- Channel 13

Commonly called the Bridge to Bridge frequency, Channel 13 sees use as a safety channel for communications between vessels and between ships and coast stations. Vessel movements, maneuvering and directing is conducted here. Channel 13 is used as a working channel at many locks and bridges, but its primary purpose is for navigation coordination between ships passing or meeting each other on the water.

Port Operations

- Channel 5
- Channel 12
- Channel 14
- Channel 20
- Channel 65
- Channel 66
- Channel 73
- Channel 74
- Channel 77

For the marine monitor, these Port Operations channels will be a prime target for activity. Ship to ship and ship to coast activity takes place here, with messages about operational handling, movement and vessel safety.

Commercial pilots who handle docking of ships often communicate on Channel 77. Channels 11, 12, 13 and 14 are used on the Great Lakes, Saint Lawrence Seaway and at major ports to coordinate vessel traffic.

These channels are used extensively on our nation's 26,000 miles of navigable rivers, canals, lakes and coastal regions. Ports are mazes of activity, as are locks, bridges and areas along rivers and canals. Coordination of this activity takes place on Port Operations channels.

Non-Commercial Operations

- Channel 9
- Channel 68
- Channel 69
- Channel 70
- Channel 71
- Channel 72
- Channel 78

Non-commercial operations refers to recreational boats and any other vessels not used for commercial marine transportation. Vessel to vessel information is passed here, such as fishing, rendezvous, berthing, maneuvers, scheduling of repairs, provisioning, etc. Most communications are ship to ship and you will hear quite a bit of talk here between fishermen and weekend sailors. I like to call these "chatter" channels, because the communications are often candid and interesting.

The United States Coast Guard estimates that there are over 18 million registered recreational boaters. Bearing in mind that almost every vessel afloat has a two-way radio, this makes for radio traffic galore on the non-commercial channels.

Commercial Operations

- Channels 7 - 11
- Channel 18
- Channel 19
- Channel 67
- Channel 79
- Channel 80
- Channel 88

Commercial channels are heavily used near ports and waterways for communications between commercial transport vessels or between commercial transport vessels and coast stations. Recreational boaters are not heard here.

Commercial communications include coast to ship and ship to coast stations, piloting, resupply, repair, maintenance, arrival and departures, and mooring. Ships using these frequencies include commerce carriers, cruise ships, barges, salvors, and ferries.

State and Environmental

- Channel 17
- Channel 15

Regulation, control and coordination of boating activities is handled on Channel 17. This includes Harbor Patrol and Police, Lifeguards and state organizations. You might hear offshore race control and fishing competitions, as well as local marine law enforcement using this channel.

Channel 15 is for one-way broadcasts from coast stations of information relating to weather, wind, sea conditions, notices to mariners and navigation hazards. Vessels do not transmit on this frequency, only shore stations.

United States Coast Guard

- Channel 16
- Channel 22 (A)
- Channel 23
- Channel 81
- Channel 82
- Channel 83

The United States Coast Guard is responsible for rendering assistance to vessels in distress on the high seas. Contact between ships requesting help and Coast Guard shore stations is usually carried on Channel 16. Thereafter, in order to free up the channel for other communications, transmissions are switched to a Coast Guard working frequency — usually Channel 22A.

In addition to civilian liaison, 22A is the common channel for Notices to Mariners and Hazards to Navigation broadcasts. These can be extremely informative and often relate information about military exercises and special events on the water that may lead a monitor to better listening. Efforts to repair an underwater sewage pipe off San Diego resulted in a series of information broadcasts which advised me of when to listen for communications on other channels. America's Cup race information was announced in a Notices to Mariners, which helped me learn when the races where occurring.

The Oceanside, CA-based CGC POINT HOBART is a 41-foot patrol boat.

Channels 23, 82 and 83 are frequencies used for Search and Rescue communications between ships, aircraft and shore stations of the Coast Guard. I've heard a CG helo coordinating a search for an overdue diver here, as well as communications as a cutter and helicopter responded to a ship at sea to evacuate a wounded passenger.

Coast Guard communications are always interesting and exciting, reflecting the often dramatic events that take place on our waterways.

Coast Guard Primary	157.150
Coast Guard Auxiliary	157.175
Coast Guard Liaison	157.100
Coast Guard Liaison	157.125
Helicopters and Cutters	157.050
Helicopters and Cutters	157.075
Distress and Calling	156.800
General Operations	156.550
General Operations	156.600
General Operations	156.700
Search and Rescue	156.350
Search and Rescue	237.900 (AM mode)
Search and Rescue	282.800 (AM)
Air to Ground	237.900 (AM)
Air to Ground	240.600 (AM)
Air to Ground	275.100 (AM)
Air to Ground	285.000 (AM)
Air to Ground	381.700 (AM)

Marine Operator

- Channels 24 - 28
- Channels 84 - 88

"This is the San Pedro Marine Operator to the vessel SEA DRAGON. SEA DRAGON, go ahead." "Good afternoon, this is SEA DRAGON, CF23453. I'd like to place a collect call to the following number: area code 619-555-4432." "619-555-4432, is that correct, SEA DRAGON?" "Yes, ma'am, it is." "Thank you, stand by."

Each day thousands of ship to shore telephone calls go out on VHF channels in the 161 - 162 MHz range. These calls are full duplex, meaning both parties can be heard speaking on the same frequency just like a normal land telephone call. Everyone from recreational boaters to cruise ships to commercial fishermen use these frequencies to speak with folks on land.

I recommend searching between 161 - 162 MHz for ship to shore calls. Weekends are especially busy, as are holidays and activity peaks during the summer months.

Cruise ships like the EMERALD ISLE of the Carnival Line may be heard during port and harbor operations in the maritime band.

Weather

The National Oceanic and Atmospheric Association (NOAA) maintains a nationwide system of three hundred eighty broadcast-only frequencies advising the public (and especially boaters) of current and forecast weather for land and sea areas. Each station has a range of approximately forty miles and operates in Narrow Band FM mode.

One or more of the following frequencies will be in use in your area:

WX 2 162.400
WX 5 162.450
WX 3 162.475
WX 6 162.500
WX 7 162.525
WX 1 162.550

Severe weather watches and warning broadcasts are of special interest to marine monitors. When serious weather conditions are forecast or expected, check commercial and non-commercial channels for ship to ship and ship to shore communications. US Coast Guard frequencies will also be active with vessel assistance and search and rescue (SAR) operations.

Part of my daily routine is a check of my local NOAA weather radio frequency. Weather affects all services that can be monitored on a scanner. Not only will it lead you to interesting maritime "catches", but it will point the way toward other communications in affected areas.

MARINE MONITORING

The sea can be a dangerous place. It is unforgiving of error or miscalculation. From the coastline to the rivers, lakes and canals of our inland waterways, maritime communications provide a voice link between vessels engaged in business and pleasure on the water. It can be dramatic listening, or it can be rather boring, but one thing that it always provides is radio action.

Comprehensive VHF Maritime Frequency List

156.0000 Worldwide	Ch 01 - International Only
156.0250 Worldwide	Ch 60 - International Only
156.0750 Worldwide	Ch 61 - International Only
156.1000 Worldwide	Ch 02 - International Only
156.1250 Worldwide	Ch 62 - International Only
156.1500 Worldwide	Ch 03 - International Only
156.1750 Worldwide	Ch 63 - International Only
156.2000 Worldwide	Ch 04 - International Only
156.2250 Worldwide	Ch 64 - International Only
156.2500 Nationwide	Ch 05 - Port Operations
156.2750 Nationwide	Ch 65 - Ship/Shore Port Operations
156.3000 Nationwide	Ch 06 - Ship/Ship Safety Channel
156.3250 Nationwide	Ch 66 - Ship/Shore Port Operations
156.3500 Nationwide	Ch 07 - Ship/Shore Commercial
156.3750 Nationwide	Ch 67 - Ship/Shore Commercial

156.4000 Nationwide	Ch 08 - Ship/Shore Commercial
156.4250 Nationwide	Ch 68 - Ship/Shore Non-Commercial
156.4500 Nationwide	Ch 09 - Ship/Shore Commercial-Non Comm
156.4750 Nationwide	Ch 69 - Ship/Shore Non-Commercial
156.5000 Nationwide	Ch 10 - Ship/Shore Commercial
156.5250 Nationwide	Ch 70 - Ship/Ship Non-Commercial
156.5500 Nationwide	Ch 11 - Ship/Shore Commercial
156.5750 Nationwide	Ch 71 - Ship/Shore Non-Commercial
156.6000 Nationwide	Ch 12 - Ship/Shore Port Operations
156.6250 Nationwide	Ch 72 - Ship/Ship Non-Commercial
156.6500 Nationwide	Ch 13 - Ship/Shore Bridge-to-Bridge
156.6750 Nationwide	Ch 73 - Ship/Shore Port Operations
156.7000 Nationwide	Ch 14 - Ship/Shore Port Operations
156.7250 Nationwide	Ch 74 - Ship/Shore Port Operations
156.7500 Nationwide	Ch 15 - Ship/Shore Environmental
156.7750 Worldwide	Ch 75 - International Only
156.8000 Nationwide	Ch 16 - Ship/Shore Calling/Distress
156.8250 Worldwide	Ch 76 - International Only
156.8500 Nationwide	Ch 17 - Ship/Shore State Control
156.8750 Nationwide	Ch 77 - Ship/Ship Commercial
156.9000 Nationwide	Ch 18 - Ship/Shore Commercial
156.9250 Nationwide	Ch 78 - Ship/Shore Non-Commercial
156.9500 Nationwide	Ch 19 - Ship/Shore Commercial
156.9750 Nationwide	Ch 79 - Ship/Shore Commercial
157.0000 Nationwide	Ch 20 - Ship/Shore Port Operations
157.0250 Nationwide	Ch 80 - Ship/Shore Commercial
157.0500 Nationwide	Ch 21 - Government USCG
157.0750 Nationwide	Ch 81 - Government USCG
157.1000 Nationwide	Ch 22 - Government USCG/Civilians
157.1250 Nationwide	Ch 82 - Government USCG
157.1500 Nationwide	Ch 23 - Government USCG
157.1750 Nationwide	Ch 83 - Government USCG
157.2000 Nationwide	Ch 24 - Marine Telephone (Ship)
157.2250 Nationwide	Ch 84 - Marine Telephone (Ship)
157.2500 Nationwide	Ch 25 - Marine Telephone (Ship)
157.2750 Nationwide	Ch 85 - Marine Telephone (Ship)
157.3000 Nationwide	Ch 26 - Marine Telephone (Ship)
157.3250 Nationwide	Ch 86 - Marine Telephone (Ship)
157.3500 Nationwide	Ch 27 - Marine Telephone (Ship)
157.3750 Nationwide	Ch 87 - Marine Telephone (Ship)
157.4000 Nationwide	Ch 28 - Marine Telephone (Ship)
157.4250 Nationwide	Ch 88 - Ship/Ship Commercial
157.4500 Worldwide	Ch 29 - International Only
157.4750 Worldwide	Ch 89 - International Only
157.5000 Worldwide	Ch 30 - International Only

157.5250 Worldwide	Ch 90 - International Only
157.5500 Worldwide	Ch 31 - International Only
157.5750 Worldwide	Ch 91 - International Only
157.6000 Worldwide	Ch 32 - International Only
157.6250 Worldwide	Ch 92 - International Only
157.6500 Worldwide	Ch 33 - International Only
157.6750 Worldwide	Ch 93 - International Only
157.7000 Worldwide	Ch 34 - International Only
157.7250 Worldwide	Ch 94 - International Only
157.7500 Worldwide	Ch 35 - International Only
157.7750 Worldwide	Ch 95 - International Only
157.8000 Worldwide	Ch 36 - International Only
157.8250 Worldwide	Ch 96 - International Only
157.8500 Worldwide	Ch 37 - International Only
157.8750 Worldwide	Ch 97 - International Only
157.9000 Worldwide	Ch 38 - International Only
157.9250 Worldwide	Ch 98 - International Only
157.9500 Worldwide	Ch 39 - International Only
157.9750 Worldwide	Ch 99 - International Only
158.0000 Worldwide	Ch 40 - International Only
158.0500 Worldwide	Ch 41 - International Only
158.0500 Worldwide	Ch 41 - International Only
158.1000 Worldwide	Ch 42 - International Only
158.1500 Worldwide	Ch 43 - International Only
158.2000 Worldwide	Ch 44 - International Only
158.2500 Worldwide	Ch 45 - International Only
158.3000 Worldwide	Ch 46 - International Only
158.3500 Worldwide	Ch 47 - International Only
158.4000 Worldwide	Ch 48 - International Only
158.4500 Worldwide	Ch 49 - International Only
158.5000 Worldwide	Ch 50 - International Only
158.5500 Worldwide	Ch 51 - International Only
158.6000 Worldwide	Ch 52 - International Only
158.6500 Worldwide	Ch 53 - International Only
158.7000 Worldwide	Ch 54 - International Only
158.7500 Worldwide	Ch 55 - International Only
158.8000 Worldwide	Ch 56 - International Only
158.8500 Worldwide	Ch 57 - International Only
158.9000 Worldwide	Ch 58 - International Only
158.9500 Worldwide	Ch 59 - International Only
161.6000 Nationwide	Ch 20 - Ship/Shore Port Operations
161.8000 Nationwide	Ch 24 - Marine Telephone (Shore)
161.8250 Nationwide	Ch 84 - Marine Telephone (Shore)
161.8500 Nationwide	Ch 25 - Marine Telephone (Shore)
161.8750 Nationwide	Ch 85 - Marine Telephone (Shore)
161.9000 Nationwide	Ch 26 - Marine Telephone (Shore)
161.9250 Nationwide	Ch 86 - Marine Telephone (Shore)
161.9500 Nationwide	Ch 27 - Marine Telephone (Shore)
161.9750 Nationwide	Ch 87 - Marine Telephone (Shore)
162.0000 Nationwide	Ch 28 - Marine Telephone (Shore)

RAILROADS

There's A Train Coming!

The Atchison, Topeka and Santa Fe local line runs three times a week through my town, on tracks just a half mile from where I live. When the wind blows with any force out of the west, I can hear the wail of the train's whistle as it approaches each intersection. If it is particularly quiet I can hear the tracks vibrating under the weight of the wheels as it passes — a low rumble, rumble, rumble in the air.

The scanner in my office comes alive as the train advances, with track and signal workers on the Road frequency loading and off-loading materials such as wood and siding for the lumber companies in town. Cars left behind from the last run are hooked up to the engine with a judicious amount of coaxing from track workers: "Four cars...three cars....one car. Slow.....Stop! All forward!"

More than once I have been stuck at an intersection as the lighted crossing rails came down. I've had the good fortune to be scanner equipped with a front row seat as the engine passed, backed, hooked up cars or dropped them off. Most of the communications are simplex — short range handhelds carried by the crews.

Always there is the low rumble that rattles everything in sight, as if an earthquake tremor were rolling steadily through, and the flat "whack" of steel on steel as the cars meet.

There is something about a train that stops all kinds to watch it pass...

TYPES OF TRAINS

There are over 167,964 miles of rail lines in the United States. Over these steel tracks travel both freight and passengers on local branch lines passing through towns and on main lines heading out on intercontinental trips.

Freight cars come in different shapes and sizes — open car, box car, flat car, livestock car, refrigerator car, tank car, rack car and piggyback flatcar. These are the workhorses of the rail fleet, transporting over 8,000 million metric tons of freight each year.

Passenger trains cover both main line AMTRAK, which transports people in style across most of the United States, to local lines like San Francisco's BART (Bay Area Rapid Transit) and San Diego's Trolley.

Yesterday's trains were powered by steam, billowing off in white clouds as the line blew through a station, but today's locomotives are predominantly diesel-powered with electric motive power a close runner up on many local passenger lines.

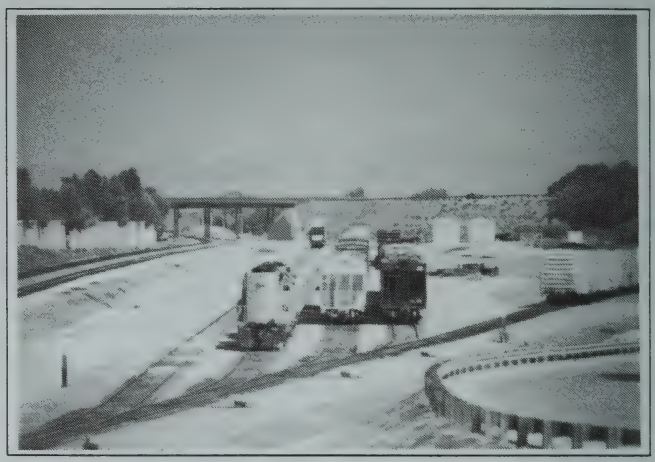
RAIL COMMUNICATIONS

They say that if you put your ear to the tracks, you will hear the train coming from miles away. I believe them, but I would rather just switch on the scanner. It keeps me off the tracks, and is quite a bit safer.

Road

Probably the most popular frequency among rail scanner monitors is the ROAD channel. The working communications of a train in motion take place here: train to dispatcher, dispatcher to train, dispatcher to maintenance crews, train to maintenance crews.

In addition you might hear PBX communications, which are simply a radio to phone line connection. For instance, if a engineer aboard a freight locomotive needed to call his boss in, let's say, Omaha, he would transmit the correct DTMF to access the PBX system and then dial the number he wished to connect with. A second frequency would send the carrier (open frequency, much like an open phone line) back to the engineer so that a two-way conversation would be possible.



Santa Fe rail yard and switching tracks. Out of view in this shot is the large antenna that allows communications with these trains.

Wayside detector will also be heard on Road channels. The most popular is called the Talking Hot Box Detector. HBD's are devices placed on the tracks to inspect the roller bearings on the wheel axles of the trains. If one of the bearings becomes overheated, the infra-red camera mounted on the track will detect this and transmit a low-powered recorded (often computer simulated) voice over the Road channel. This message will alert the engineer or conductor that the detector has found a defect.

A defect warning from a Talking Hot Box Detector of the Union Pacific Railroad would sound similar to this (usually preceded by five loud tones) "UP Detector, milepost twenty three point zero, first hotbox, axle eight, right side (then the message would repeat, followed by) Detector out." If no defects are found a "No Defect" message would be relayed.

Other frequencies

The rail yard is much like an airport at times, with trains moving in all directions, controlled by a Tower which oversees the surrounding tracks. The tower operator sees to it that trains are routed appropriately as they pass through. Tower communications are found on the *Yard* frequency. *Hump* frequencies cover communications between carmen as they control cars on a "hump" or hill. Cars are directed onto the correct

track for hook-up from the hump. *Maintenance* frequencies pertain to operations by track workers repairing sections of track or cars and are communications are usually low powered.

Most railroads maintain their own police departments to ensure law and order along the tracks. *Police* frequencies will carry communications between rail officers, both on and off the train, as they deal with rowdy passengers, children playing on the tracks and illegal riders.

FINDING RAIL COMMUNICATIONS

The Federal Communications Commission (FCC) designates 160.215 - 161.565 MHz for railroad radio communications. Between these ranges you will find all of the frequencies discussed above.

Your location depends a great deal on how much you will hear. Listeners near major rail yards will be treated to twenty four hour action, while listeners along the line may hear communications only when the train is within range. With a rooftop mounted antenna, I'm able to hear rail communications from up to sixty miles away.

Stop by a passenger train station sometime and pick up a copy of their schedule. This will help you determine which trains operate in which areas and when they might be in listening range. Freight schedules are also available. Don't neglect your local city or county map as a way of finding rail activity. Most railroads are shown on street and topographical maps.

Finally, when you have determined the nearest rail line and the time when a train might pass, drive down and park along the way with your scanner. It might take some time, but eventually you will hear the hoot of the whistle and see the white piercing eye of the engine headlight approaching. The ground will shake and the very air will echo with the sounds of the train as it chugs past.

Scan carefully and in addition to regular frequencies, you might find some short-range channels in use between workers on the train. Welcome to the world of rail scanning. Don't be surprised if you get hooked on it, rail land transportation will not soon fade away.

SPORTS & ENTERTAINMENT

Monitoring Bats, Sticks, Baseballs and Mickey Mouse

SMACK! Down on the ice, two hockey players take a headlong dive into the dasher boards and the crowd around me leaps to its feet, screaming, hollering, rooting as the two players from opposing teams begin throwing fists around.

In the middle of it all, I'm up in the stands, furiously punching buttons, trying to track down active frequencies here at the sports arena. The roar of the crowd makes hearing difficult, even with headphones donned and the volume up. Folks had told me how much fun sports and entertainment monitoring could be and so I couldn't resist loading up the scanner for the next game. What I didn't realize what how much more interesting the radio traffic was than the actual game!

As the players are finally separated, one of them ends up flat on the ice and the team trainer slides out to assist him. Before long he's signalling to the bench and suddenly the scanner locks up on 154.600 MHz.

"Medical, send a gurney to the ice." "10-4, it's on the way."

In rapid succession, two other frequencies come alive with transmissions that I identify as security and a second medical channel. This channel stays active and I hear talk about injuries, an ambulance and the team doctor. When the decision to transport the injured player to a nearby hospital is made, all the details are heard via scanner.

Other frequencies encountered were those belonging to maintenance, concession stands, press box, TV camera crews, sports arena staff, and a local police tactical frequency that was used to coordinate police activity at the game.

The action wasn't only on the ice, it was all around me and I could monitor it on my scanner!

SPORTS MONITORING

A sporting event requires extensive coordination to bring it off successfully and safely. The finest way to coordinate is through the use of two-way radios, putting all elements of the behind the scenes staff in instant contact with each other.

Concession stands can order up extra materials by radio, maintenance crews can be dispatched to repairs or clean-ups, security teams can keep track of trouble spots and summon instant assistance, the press box can communicate reports using radio, and on-air announcers may broadcast commentary by radio link.

Any place a sporting event occurs is a potential target for a scanner monitor. Pit crews and drivers at car races communicate by radio, talking about strategy, pit stops, lap information, and mechanical difficulties.

See those headset/boom mikes worn by the coaching staff on the sidelines at football games? Turn on your scanner and you'll hear strategy and tactics conferences, as well as television crews, press box transmissions and even the on-the-field referees calling penalties. Some NFL teams are wiring their players with radios so that instructions can be relayed from the quarterback to teammates.

Participants in bicycle, motorcycle and foot races have taken to wearing radios, so in addition to security, medical, concessions and maintenance, you can listen to conversations between the competitors.

Going to the boat races? Take your scanner along. From speedboats to the America's Cup, you can monitor the action on the air. Try 470 - 475 MHz and don't forget to give the marine frequencies a spin (156 - 158 MHz.) You'll hear race commentary, safety boats, camera boats, Coast Guard and Harbor Patrol, rescue and emergency crews, and even participants receiving instructions from the judges.

The best thing I ever did was take my scanner to the air show. Civilian aerial acts are active on frequencies in the 121 - 124 MHz range. You will be able to actually monitor conversations between pilots as they perform high up in the wild blue. (See military air frequencies at the end of this chapter.)

ENTERTAINMENT SCANNING

No self-respecting scanner listener ever wanders around Disneyland without a scanner in hand and local park frequencies programmed in. This holds true for Knott's Berry Farm, Magic Mountain, and even your local zoo. The zoo? You bet!

Any visitor attraction, be it a zoo or an amusement park uses radio to coordinate security, maintenance, medical, productions, transportation, and parking, among a host of other things. I've listened to park rangers inspecting wildlife and perimeter fences at the San Diego Wild Animal Park and trainers on wireless microphones as they performed shows with marine mammals at Sea World. Some of things you hear will be more entertaining than the attraction itself.

A short-circuited monorail remained stuck on the tracks for an hour and a half before maintenance crews could repair it. Passengers were up in arms and numerous calls of "the natives are getting restless" circulated on security and monorail control frequencies. A few objects were thrown, but luckily the monorail was repaired and on its way before too many outraged passengers jumped ship.

Wireless Microphones

Some listeners have reported success in monitoring wireless microphones used by entertainers. A few have even parked in the parking lot of a stadium or arena and monitored the concert on their scanner, all for free!

Nightclubs, concert halls, outdoor assemblies, arenas, stadiums, and even restaurants hire entertainers ranging from stand-up comedians to live bands. Many of these people utilize wireless microphones in their acts. Though the range is short because of the low power of the mikes, it is possible to hear these transmissions if you're close enough.

Experiment by searching through the 169.000 - 175.000 MHz band. Wideband FM mode is often used to produce stereo sound. Your scanner will need to be able to manu-

ally switch to WBFM on some of these frequencies. Also, try the following confirmed low band channels used by wireless mikes:

36.700
37.100
37.160
40.680
42.890
44.870
47.270

Some commercially available wireless mikes operate on dead spots in the FM broadcast band. Check 88 - 108 MHz. Also, 49.000 - 50.000 MHz might yield a few catches, check there also.

In all cases, the closer you are, the better your chances of hearing anything. Wireless microphones are intended to transmit very short distances to amplifier equipment on stage, so low power is used.

Where to search

Sports and entertainment communications pop up in odd places across the radio spectrum, but there are common bands to search that will usually yield good results.

151.000 - 154.000
461.000 - 469.000
851.000 - 857.000

The 800 megahertz band frequencies are becoming increasingly popular, especially among auto racing teams. Be aware that frequencies often change from time to time as teams attempt to keep rivals from doing any unwanted listening. The frequencies you find active today might change next time you listen. Keep a list and don't be afraid to add to it.

Security teams may operate on business frequencies, itinerant color dot frequencies in the 150 Mhz band or little used city assigned frequencies. Pay careful attention to police tactical or special use frequencies, which often becoming active during sports events.

Maintenance and concessions can usually be found transmitting on the business bands between 461 - 469 MHz. Some of these communications may be low powered or even occur in the 49 megahertz band (vendors have been heard here.)

If you're at a boat race or an air show, don't neglect marine and aeronautical frequency ranges. Communications are often carried out on "common" frequencies within these ranges, such as bridge to bridge and air to air.

Of course, a great idea is to bring along a frequency counter for positive identification of those hard to find frequencies. Use caution, however, security might take a second look at you. Discretion will save you quite a bit of embarrassment and hassle.

MOTION PICTURE INDUSTRY

"Lights, Camera, Action" is the universal director's cue to his crew to activate their equipment and it's your cue to activate your scanner.

A motion picture, whether it is filmed for the big screen or television, is a complex affair, comprising actors, directors, producers, camera-people, special effects crews, location and production managers, make-up artists, electricians, set construction crews, and a maze of other people, all employed to bring the production off successfully. The key to success is coordination, which is best effected through the use of radios.

Most motion picture filming is done on sound stages located on studio lots. These lots are closed to the public, unless you happen to hold a ticket for a live taping of a television series or talk-show. TV and big screen movies usually have strict visitor policies and getting anywhere close to them is a trial. The monitor's best chance is to follow the production crew "on-location."

Location filming, just like the name implies, is done away from the sound stages and studios. More than ever radio comes into play to coordinate the people involved.

A scanner monitor who is close to an on-location shoot is in for some fascinating listening. Try scanning the following frequency ranges for activity:

173.275 - 173.375 MHz
152.870 - 153.020 MHz

Don't forget that cellular telephones see heavy use among production crews, and assistants always seem to be on the phone to someone. Take a swing through the 869.000 - 896.000 MHz range, as well.

I don't mean to imply that on-location shoots are the only places a monitor will hear motion picture activity. If you take a Universal or Paramount Studios tour you will hear production communications as well as the usual security and concessions calls. Many shows are filmed on these lots, and occasionally tour operators allow visitors very close to live tapings. Keep the scanner rolling, you never know what you'll hear!

SPORTS AND ENTERTAINMENT FREQUENCIES TO TRY

Disneyland and Epcot Center

462.575 Monorail
464.400 Security Parking
462.125 Security Control
462.625 Rescue and Watercraft Transportation
462.675 EPCOT Maintenance Base
464.625 Magic Kingdom Maintenance Base
462.550 Show Control
463.975 Entertainment
463.750 EPCOT Disney Village Security
462.850 Paging 855 - 860 Walt Disney World 800 MHz system

United States Navy Blue Angels Air Demonstration Team

241.400 Blue Angels-A/A
250.800 Blue Angels-A/A
251.600 Blue Angels-A/A-Solos 5-6
275.350 Blue Angels-A/A-1 to 4
360.400 Blue Angels-A/A
384.400 Blue Angels-A/A
391.900 Blue Angels-A/A
395.900 Blue Angels-A/A

Plane 1 Flight Leader "Boss"
Plane 2 Right Wing
Plane 3 Left Wing
Plane 4 Slot Pilot
Plane 5 Lead Solo
Plane 6 Opposing Solo
Plane 7 Narrator (spare aircraft)
Plane 8 Events Coordinator (spare aircraft)

United States Air Force Thunderbirds Air Demonstration Team

236.550 Thunderbirds-A/A-Solos 5-6
236.600 Thunderbirds-A/A
241.400 Thunderbirds-A/A
250.850 Thunderbirds-Team Leader
273.500 Thunderbirds-A/A
283.500 Thunderbirds-A/A
322.300 Thunderbirds-A/A
322.600 Thunderbirds-A/A
382.900 Thunderbirds-A/A
394.000 Thunderbirds-A/A

America's Cup Yacht Racing Frequencies

470.0125 Active - DES (Racers)
470.1375 Director Net 1
470.1875 Active - Use unknown
470.2375 Press Relations
471.7375 AmCup Data Buoy (non-voice)
471.8375 Buses
470.3875 Active - Use unknown CH 2
470.4375 Video Engineering - CH 10
470.4875 Race Commentary - CH 3
470.5375 Race Management - CH 1
472.0625 Active - DES (Racers)
470.5875 Director Net 2
470.6375 Engineering - CH 17
470.6875 Data - Camera Control
470.7625 Data - Camera Control

470.8125 French Team (May change)
470.8375 Active - DES (Racers)
470.9375 Data
472.4625 GPS systems support
471.0375 Active - Use unknown
471.0875 Race Control "Yellow"
471.1375 Race Committee "Blue"
472.6875 Possible simplex use
472.7875 Possibly Active
471.3375 Citizens Timing
471.3875 Maintenance - Radio Techs
471.4375 Active - Use unknown
156.300 Simplex Race Commentary (VHF Ch.16)

Indianapolis 500 Frequencies

Car	Driver	Frequency
1	Arie Luyendyk	859.425
2	Al Unser, Jr	457.8125
3	Rick Mears	852.1875
4	John Andretti	462.650
5	Emerson Fittipaldi	856.9125
6	Mario Andretti	462.650
7	Hiro Matsushita	465.9125
8	Eddie Cheever	462.2625
9	Kevin Cogan	472.1375
10	Michael Andretti	461.700
11	Pancho Carter	466.5875
12	Mark Dinsmore	Unknown
14	A.J. Foyt	936.6625
15	Scott Goodyear	857.8375
16	Tony Bettenhausen	464.525
17	Willy T. Ribbs	462.2125
18	Bobby Rahal	460.7125
19	Scott Pruett	467.750
20	Danny Sullivan	466.3125
21	Geoff Brabham	461.0125
22	Scott Brayton	465.0125
23	Tero Palmroth	462.725
25	Phil Krueger	Unknown
26	Jim Crawford	467.7625
31	Ted Prappas	Unknown
37	Guido Dacco	464.0625
39	Randy Lewis	460.6875
48	Bernard Jourdain	Unknown
50	Mike Groff	Unknown

51	Gary Bettenhausen	Unknown
66	Dominic Dobson	Unknown
71	Buddy Lazier	Unknown
77	Salt Walther	Unknown
86	Jeff Andretti	466.6875
91	Stan Fox	Unknown
93	John Paula, Jr	Unknown
97	Dean Hall	471.8125

Unrecognized Drivers:	465.325
	466.0125

USAC 1 Primary	935.1375
USAC 2 Secondary	935.150
USAC 3 Secondary	936.6375
USAC Safety	466.6875
USAC Safety	461.5875
USAC Safety	461.6875
USAC Safety	464.6375
Indy Radio	498.550
Infield Hospital	155.265
IMS	151.685
IMS	151.775
Pace Car	452.575
Horton Emergency Center	464.8875

Frequencies, car assignments and drivers subject to change, but these should help you narrow down the search.

Paramount Pictures

153.020	Location Manager and Production Crew
152.990	Production Crew
152.930	Production Crew
152.960	Special Effects/Set Construction

NEWS MEDIA

Film At Eleven . . .

"Ten seconds out....cue up VTR One, final mike check. Camera three will take the first shot. Cue music, roll intro. We've got a dark area behind the anchor, get a light on that...We're live in three, two, one...downscreen in.....aaaaand out. Ready VTR One...five seconds...and roll. Okay, anchor's out....Camera three, check your framing...downscreen in....aaand out. Twenty seconds in the B-roll, are we ready for the remote? Yes? Okay, Camera one has the view coming out of this tape....anchor's live with camera one and ready remote. Going to remote in three, two, one....downscreen in....aaaand out. We have bad audio, remote crew check your mikes. Okay, that does it, audio is good....roll VTR three, thirty seconds in the B-roll ... downscreen in....aaaand out. There's still a dark area behind the anchor! Can we fix that while we're in the B-roll?..."

The news media is our ever-present link with what is happening on our planet. Fires, murders, accidents, wars, politics, economics...our world is always in turmoil and it's the job of the news departments to keep the public updated on it all. There's world news at six, local at five and eleven and special reports that keep us up to date on breaking stories in between. The television broadcasts always have a very polished appearance, with stories well written and reported, commercials in the proper places, video tape rolling at the right times.

But, have you even wondered what it takes to put together a newscast? How reporters find stories and what they go through to get them? How anchors know what to read, what story is next and when the video tape should roll? Your scanner can take you behind the scenes of local television news teams, and those of radio stations and newspapers, as well, opening up new avenues, and new monitoring targets. For a scanner monitor, keeping an ear to what the news teams are up to is often an excellent way of tapping into breaking news.

WHERE TO FIND 'EM

News Media radio communications — television, radio and newspaper — can be found in specific FCC allocated bands:

25.600 - 26.470
152.870 - 153.395
161.640 - 161.760
173.225 - 173.375
450.000 - 451.000
452.975 - 453.000
455.000 - 456.000
944.000 - 952.000

WHAT YOU'LL HEAR

News Desk

The News Desk is responsible for dispatching reporter/cameraperson crews to breaking events. These events are usually local, but might include statewide incidents also. The Assignments Editor working the radio also hears about events from his reporter crews in the field and coordinates their activities, deciding which incidents are truly newsworthy and which are not.

For a scanner monitor, News Desk communications provide a way to hear about events that might not otherwise be caught during regular scan of public safety frequencies. I was alerted to a high speed Highway Patrol chase on the freeway by listening to a News Desk dispatcher. Switching over to the proper frequency allowed me to listen in on the live action, which I would have missed otherwise. (Occasionally, reporters even give the frequency on which they're hearing the action.)

Also, details about events can be heard before they hit the daily news report, including information that news editors decide not to air. A fire in a nearby sports club was the result of arson, which I found out by listening to a reporter relaying the results of his interview with the fire chief back to the News Desk. The chief requested that the news crew not broadcast this information to the public just yet. That information never made it to air, but by listening to News Media transmissions, I was able to find out about it.

News Desk communications are most active during the day, as reporters respond to incidents and film and interviews for upcoming stories is shot. Whatever airs on the nightly local news will usually be discussed sometime during the day, putting the listener one step ahead of the pack.

Remote Broadcasts

You've undoubtedly seen the wind-blown reporter, microphone in hand, reporting live from the scene. His live remote broadcast is coordinated by radio with people back in the studio. Everything from lighting to audio levels is heard being arranged. Studio personnel must advise the live crew when their piece will go on the air and you will hear countdown advisories, as well as information about when the remote reporter is on the air, when the tape related to his story rolls, how much time in the tape is left and when the reporter is live again.

Additionally, questions are sometimes directed from the on-air personalities in the studio to the reporter on live assignment. These questions are well rehearsed beforehand and the reporter knows exactly what the question will be, who will ask it and what to answer.

Live shots are often perilous undertakings, as they sometimes occur from locations which are difficult to broadcast a microwave signal from. I have heard crews struggling to properly set up a shot with seconds left before air time. I've heard the chaos that ensues when audio cuts out or the picture breaks up. And the hilarity of miscues, mis-steps, and unexpected occurrences.

Live shots are common on television news, sometimes two or three per show, and their coordination is always by radio link.

Live radio broadcasts are also a good monitoring target. When announcers broadcast live on-location for publicity purposes, their on-air broadcasts are relayed

back to the station via radio frequency. You'll also hear segments being set up between disk jockeys and engineers at the studio. Check the News Media bands for this. Note that the Electronic Communication Privacy Act makes it illegal to monitor Remote Broadcast Pickups.

Engineering

The paragraph at the beginning of this chapter illustrates the patter that continues non-stop during the production of a television newscast. Every camera shot, every picture, videotape roll and reporter name that appears on screen is controlled by the studio director. He or she is also responsible for timing the show and assuring that each segment meets its allotted time. If it does not, the director must rearrange segments and videotape to fix the discrepancy, as well as alert the on-air personalities to the change.

Many a director's communications with the studio crews can be heard live over your scanner. Some can be heard regularly and some only during special broadcasting events. Regardless, Engineering is what makes the broadcast work and listening in is a fascinating look "behind the scenes" of a news production.

Live News

Many stations broadcast live audio directly from the on-air personalities' microphones. The audio includes whatever is said immediately before the broadcast, during commercial breaks and immediately after the broadcast. It can be interesting, enlightening and often quite funny. Some say there is no substitute for watching the news on television and listening to the "off-air" chatter.

Check the wireless microphone ranges for these on-air transmissions. Common frequencies include: 174.000, 186.000, 210.000.

On-location news crews communicate via handheld radio and also broadcast live audio audible on scanners.

Helicopter Traffic Reports

"Greater Riverdale freeway westbound to the Forty-four is backed up, emergency crews working a three car pile-up on the right shoulder. Fog in the Frankville Valley creating a slow-down, watch for brake lights as you cross the Two-Ten eastbound and a mattress in the number one lane of the Two-Ten might cause some problems, so be careful. Tony Collins, Air One reporting."

Helicopter traffic reports originate — as you might guess — from helicopters. Conventional radio frequencies in the News Media bands are used by airborne reporters to communicate through their base control to radio and television stations.

Many of these reports are live, though some, especially those used for television, are taped for later use. It is basically the reporter's job to assemble a coherent package of information about the traffic situation and the base control's job to arrange air times with radio and TV stations and advise the reporter which station he will be reporting for.

More than once I have heard airborne traffic reporters give the wrong station ID at the end of their report. It's embarrassing and bad for business, but there is no surprise that it happens. A reporter might provide traffic reports for up to twenty radio stations in the space of one hour; keeping track of who's who is often a confusing job.

Aerial traffic reporters can be heard broadcasting mainly in the 450.000 - 451.000 Mhz band, but look for them also between 161.640 - 161.760 and 455.00 - 456.000 MHz.

Studio to Transmitter Links

Typically, television and radio station broadcast antennas are physically located on high points (often hills or mountaintops) away from the actual studios. Radio frequencies in the microwave band (944.000 - 952.000 MHz) are used to conduct the audio signal from the studio to the antennas.

Intercepting these transmissions can provide crisp, clear audio from your favorite radio or TV station at all hours. Some are active only during newscasts, so you'll have to scan carefully to hunt those down. Best times are between 5pm and 7pm local time and again from 11pm to midnight, when news broadcasts take place.

Studio to transmitter links (STL's) are broadcast in Wideband FM mode, so your scanner will have to be manually adjusted to receive signals clearly in the STL band. Note that the Electronic Communications Privacy Act makes it illegal to monitor studio to transmitter links.

Print Media

When the paper carrier is late, I usually tune into the local newspaper's delivery frequency to find out why. Not only that, but I can laugh at all the inane reasons why other folks didn't get their paper (dropped in water, tossed over fence, dog took it, cat ate it, stolen, disappeared, thrown in the wrong place.)

Newspaper delivery isn't the only print media communications to be heard on the air. Just like their media brothers, radio and TV, newspapers maintain a team of reporters and photographers who are dispatched via radio to breaking incidents. In a way, monitoring local newspaper communications may provide information on local area news that TV and radio have missed, or just don't deem newsworthy enough.

Print media (technically known as Relay Press) communications can be found between 173.225 - 173.375 MHz and 452.975 - 453.000 MHz.

FILM AT ELEVEN...

I frequently scan through the news media bands, looking for activity to supplemental my regular listening. You will be amazed at what you will scare up — information about stories you heard about or are about to hear about on the air, details that don't make it to air, "inside" comments from news personalities, and even frequencies.

Some of my best "catches" have come from monitoring the news media. When President George Bush blew through in Air Force One, I was able to find out the exact

times of arrival and departure, including what the aircraft and its passengers were doing, just by listening to reporters on the scene. This, in turn, led me to some good communications traffic from Air Force One to the White House.

I've monitored numerous aircraft emergencies and police operations simply by hearing about it on press frequencies first. Punch these ranges in and give them a try. You'll open up a whole new world.

TELEPHONES

Cordless, Cellular, Aero, Marine

The Electronic Communications Privacy Act of 1986 makes it illegal to monitor cellular telephone calls. Many state and local laws have also been enacted which prohibit monitoring cordless calls. These laws have yet to be effectively tested in court, but that is only a matter of time.

If you choose to scan the telephone bands, be advised that doing so is a violation of the law. Neither myself nor the publisher condones telephone monitoring and the information presented here is for educational purposes only.

Isn't technology great? It has allowed humanity to crawl from the Ice Age, past square wheels and sticks of fire, to an automobile, a boat or an airplane with a telephone in it.

No longer chained to the office or home, we may now venture into the outside world with no fear of missing a valuable phone call (or persistent phone salesman.) "I'm waiting for a call" is a valid excuse no more, for now the telephone can be taken along, going where no man has gone before with benefit of communications: the backyard, the car, the job site, the airways, the high seas, the restaurant, the beach, the shower.

The cellular mobile telephone has revolutionized the world of communications. Take a typical example: Joe Jones has left his office at five o'clock. En route to his home he is able to place dinner reservations, call his wife to inform her that she will not have to cook tonight, be told that meatloaf is already in the oven, have to recall the restaurant to cancel, receive a call from his boss telling him "the trip to New York is on. You leave at 5:30," have to recall his wife to explain why he won't be home tonight, get a flat, call for a tow truck, wait forty minutes, call his boss and the airport, and his wife again...

The never-ending saga of the mobile phone user. Business calls, family calls, calls to the doctor, the lawyer, the Indian chief, they are all there on the telephone bands, waiting to be intercepted.

Mobile phones have given us what television wouldn't —twenty-four hour a day, around the clock soap operas. Hear the latest bid for the high rise down on Margate Street; hear Molly tell Ted she's seeing another man; hear a couple fight, make up and fight again, all within the space of a ten minute phone call; hear a lawyer tell his client "You're going to lose this case unless you come up with an airtight alibi"; hear Aunt Renee explain her whooping cough condition to Uncle Hank, hear 911 calls, hear wedding plans made and foiled.

Life and death on mobile phones, from the mundane to the serious to the hilarious. Life played out over the airwaves. Not since the party line has man's telephone calls been so exposed for any well-equipped scanner listener to hear, and chuckle over.

DON'T LOOK NOW, SOMEONE'S LISTENING

The majority of the world believes that when they pick up a telephone, only themselves and whomever they are calling will be a party to the conversation. On normal wire-connected phones (where the handset is connected by cord to the base of the phone and a line, in turn, connects to a wall socket) this privacy is almost assured. When it comes to cordless phones, cellular phones, aero and marine telephones however, that's another story. Privacy here can be considered nearly non-existent. Conventional scanners are capable, without modification, of receiving cordless, aircraft and marine telephones. With simple modifications, most scanners can receive cellular calls, also.

Cordless Telephones

Cordless phones were once the eighth wonder of the modern world until they were surpassed by cellular car phones. This does not change the fact that any neighborhood is bound to contain a few of these devices.

A cordless telephone uses a low-power transmitter to send signals from the handset to the base portion's antenna and from the base antenna to the handset. Once the signals reach the base part of the unit, they are sent into the conventional landline wired system. Between the handset and the base unit, however, the signals drift in the air to be snatched by any receiver close enough.

The following frequencies are standard and can be found in use nationwide:

Channel	Base	Handset
1	46.610	49.670
2	46.630	49.845
3	46.670	49.860
4	46.710	49.770
5	46.730	49.875
6	46.770	49.830
7	46.830	49.890
8	46.870	49.930
9	46.930	49.990
10	46.970	49.970

On handset frequencies it is common to hear only one side of the conversation. In this case, tune to the corresponding base frequency for both sides of the transmission. Range is often one half mile or more depending on propagation conditions. Bear in mind, these are low power devices, operating a minimum of two watts. Frequency counters will need to be extremely close to measure a transmitting signal.

Cellular Telephones

There are two types of mobile car telephones. The older style "mobile phones" operate between 152.000 - 153.000 MHz, and still see heavy use in many areas. You can't miss an active mobile phone channel in this band...if you don't hear a conversation, you will hear an annoying "busy signal" beep. Many tone and voice paging services, as well as taxicab companies also operate within this range, so scan carefully.

The second type of mobile car phone is the cellular mobile, by far the most popular, with incredible amounts of voice activity day and night.

A Cellular Phone Primer

There are 666 channels assigned to the 800 Megahertz cellular mobile telephone (CMT) band by the Federal Communications Commission. 333 of these channels are overseen by a wireline company which is engaged in telecommunications. The remaining 333 channels belong to a non-wireline company, which is not in the telephone business.

The computer that runs the CMT show is known as the Mobile Telephone Switching Office (MTSO). Telephone lines link cell sites to the MTSO. The cell sites provide wide area radio coverage and each site houses one of 21 control channel transceivers. The control channel is used for switching and data delivery and has no voice components. Each site also commands up to 40 voice channel transceivers.

When a cellular user starts his or her vehicle, the mobile terminal is activated and scans all 21 control channels to find the strongest signal. Each time the vehicle moves out of range of a cell site on which the terminal is locked, transfer to the next strongest signal occurs. During the course of a telephone call, as the vehicle passes from cell site area to cell site area, handoffs result. The CMT user might notice a degradation in signal quality before the handoff, but the actual frequency switch should be unnoticeable.

This highway call box derives its power from the sun (note the solar panel at the top) to drive a cellular phone for emergency calls to the Highway Patrol.

A scanner monitor can listen in on cellular calls simply by scanning the voice channels from 869.000 MHz to 896.000 MHz. Following a call as it is handed off from cell site to cell site is not impossible to do, and there is even a scientific, though complicated method of tracking a call through the frequencies.

The hit and miss method of cellular monitoring is most often used, in which, as soon as a call is handed off from one frequency, the monitor simply hits the scan button and continues the march through the cellular frequencies until he finds the same conversation again. You'd be surprised, it works 90% of the time.

Cellular mobile telephones operate between 824.000 - 851.000 MHz for mobiles and 869.000 - 896.000 MHz for cell sites.

The difference between the two sets of frequencies is simply that between 824 - 851 you will receive signals directly from the car phone antenna itself. Signals are line of sight, so don't expect phenomenal success unless you scan in a metro area (such as New York or Los Angeles.) The vagarities of weather and atmospheric conditions apply here and will affect your reception.

Your best bet will be to scan the 869 - 896 Mhz range by setting the upper and lower frequency limits into your scanner and searching between them. Here you will receive signals directly from the cell sites, as described above.

Aircraft Telephones

Intercepting a telephone call made from forty thousand feet isn't as hard as it sounds. In fact, it's a growing trend among people to believe that it simply can't be done. But it can! And it's easy.

The following frequencies are assigned to aircraft (often called by the trade name AirFone) telephones:

Channel	Aircraft	Ground
1	454.950	459.950
2	454.900	459.900
3	454.850	459.850
4	454.800	459.800
5	454.750	459.750
6	454.700	459.700
7	454.725	459.725
8	454.825	459.825
9	454.925	459.925
10	454.875	459.875
11	454.925	459.925
12	454.975	459.975
Calling	454.675	459.675

To find which of these frequencies are active in your area, search between 454.000 - 455.000 MHz and again between 459.000 -460.000 MHz. Active frequencies usually broadcast an unscannable audio tone. Your scanner will stop on it. When a call goes out, the audio tone ceases and the dial tone is heard, followed by the initiation of the call. The audio tone resumes when both parties hang up.

New aircraft telephones have been licensed to operate between 849.000 - 851.000 MHz and 944.000 - 946.000 MHz. The 900 MegaHertz frequencies operate in Single-Side-band or SSB. Your scanner must be capable of this reception mode in order to hear clear transmissions here.

Marine Telephones

Sailors have long had the ability to use the services of the marine operator to place calls from vessels at sea. Basically, the Marine Operator on land patches the ship's radio call into the phone line, dials and monitors until the conversation is finished, at which time the connection is broken.

Marine telephones operate in the 161.800 to 162.000 MHz band. The frequency will usually open with a vessel calling the Marine Operator and remain open (full duplex, just like a regular phone call) until the call is completed.

Cellular phones are seeing quite a bit of use aboard ships, but their range prohibits their use from very far out at sea. If you happen to be hanging around a port or harbor with your scanner, try the cellular ranges too for phone calls.

Ring, Ring!

The technology that allows modern man to use his telephone in places that defy wire-connections has yet to fully resolve the issue of eavesdropping. Cordless phones are now being manufactured for use in the 900 MegaHertz range and cellular phones will soon by capable of digital transmission, which will effectively end scanner monitoring of them, until someone figures out a way to defeat that also.

The next time you pick up your cellular or cordless to place or answer a call, think about who might be listening and watch what you say!

Low Band Long Distance

Taking A Skip Trip

♦

When I tell folks that I regularly listen to police, fire and ambulance calls from three thousand miles away, I receive some strange looks in return. When I mention that I listen to range control operations at such places as Fort Bragg and Fort Knox from my location in California, folks start looking for a straight-jacket for me.

Some people give me the benefit of the doubt and ask questions: What kind of scanner picks up signals from that far away? What type of antenna do you use? Do you have to be a real expert to hear those kind of things?

Whatever scanner you use right now, with whatever antenna it has attached, will work just fine for hearing transmissions from afar, I tell them. And no, as long as you can tune a radio, you don't really need any other expertise.

Imagine listening to soldiers of the 82nd Airborne Division parachuting from C-130 Hercules airplanes, tanks on maneuvers at Fort Knox, fighter/bombers practicing target missions, infantry on ground maneuvers. Imagine hearing police responding to crimes and fire departments rolling to fires and emergencies in towns thousands of miles away. Impossible? On the contrary! Obviously, you haven't explored low band.

LOW BAND

If you were paying attention earlier, you learned about the different bands to be found on a scanner. VHF Low band, VHF-High band, UHF, and the like.

What scanner monitors call the low band exists between 30.000 - 50.000 MHz, the "basement" of a typical scanner's range. Transmissions here are affected by "skip," the phenomenon by which radio signals reflect off the earth's ionosphere and return instead of disappearing into space. Signals often return to earth hundreds or thousands of miles away from where they originated.

There are several layers comprising the ionosphere and each layer ionizes (charges) in different ways. These layers shift from day to day, month to month and year by year, creating different conditions which reflect signals.

Of the two parts of a radio wave — the ground wave and the sky wave — the sky wave is the most important for low band listening because it is this part of the signal that travels out into space. Part of the sky wave penetrates the ionosphere and is lost, another portion is absorbed by the layer and another portion is reflected back down to earth.

This reflected portion of the sky wave is what we hear. When it descends to earth, it does so at an angle, striking the earth, reflecting back up to hit the ionosphere and come down to earth again. This process continues until the sky wave becomes completely absorbed.

When it comes to skip, the lower the better. What I mean by this is that low band frequencies experience less absorption and make the "skip trip" easier than frequencies in the higher bands Beyond about 70 MHz, you'll find skip decreases markedly. Rule of thumb: stay on the low bands for best results.

Skip Types

There are three main types of skip, each corresponding to the layer of the ionosphere that reflects them: E-skip, F2-skip and Air Inversion skip. Each affects radio signals in different ways at different times of the year. It pays to understand some of the technicalities of each region in order to have any success listening on low band.

The E layer of the ionosphere is located between 62 - 100 miles above the earth, though its height changes with solar activity and the seasons. This layer rises at night from low altitude to high and therefore it most affects signals during the day. You'll see the E layer reflecting signals quite often from May through August.

The F2 layer of the ionosphere ranges between 100 - 200 miles high and is highly affected by the 11-year sunspot cycle. Sunspots will charge the F2 layer and allow it to better reflect signals. F2 skip can be found working its magic on low band from October through April during daylight hours.

Air Inversion skip can affect almost all scanner bands and is closely tied with weather conditions. It occurs mostly during May through August and can allow reception of signals on the higher bands not normally affected by E and F2 skip.

Though I have given certain times of the year when skip is most probable, I don't mean to imply that these are the only times to hear low band skip activity. Quite the opposite. Radio wave propagation is unpredictable and often surprising, popping up at unexpected times of the day and night. It is also highly variable from day to day. If you don't hear anything today, check the band again tomorrow, as conditions might have changed.

HEARING SIGNALS

Listening to skipped signals is as easy as turning on your scanner, setting a low band search range and punching the scan button. I usually set in 33.000 - 34.000 or 37.000 - 38.000 MHz, which are two prime bands for fire and emergency medical communications. Many folks punch up 42.000 - 43.000 MHz, a good area for Highway Patrol communications. If I hear activity in these areas, then I know skip is affecting the bands and it's time to search for other transmissions.

There have been occasions when I've run the 30 - 50 MHz band from top to bottom and ended up with a list of active frequencies pages long. That's what skip can do to reception.

Antennas are, of course, important for any type of scanning, but especially for low band listening. Yes, you can hear skip with the factory supplied antenna, but your chances and your range grow exponentially with the type of antenna you use.

An outdoor mounted antenna, such as a three element ground plane, discone or a beam antenna will improve your long distance catches. If you can't go that route, try a length of copper wire cut to the proper band (468 divided by the frequency equals the length of wire you need.) Even an indoor extendable whip antenna will help. Experiment and see what works best for you.

TRACKING SIGNALS

The first question I usually get about low band listening is: "How do you know who you're hearing?" Here's where a scanner listener's tenacity and a little work come into play.

Start with a set of good maps of the United States, preferably one that shows detail of each state, especially cities and towns. I use an *Encyclopedia Britannica* atlas or a *Rand-McNally* road atlas. Both work fine and can be used to cross-check names.

Secondly, get yourself a good set of frequency guides for the U.S. I have a complete set of POLICE CALL radio guides covering each state in the country for public safety frequencies, and a federal frequency book for military communications. These books are where your frequency information comes from. For positively verifying what you've heard, there's no substitute. It's not mandatory, but it makes the job so much easier.

Now, warm up the scanner and we're ready to go skip signal hunting.

As an example, let's say your scanner has stopped on frequency 42.340 MHz. Park yourself on this channel and listen to the transmissions taking place. Pay careful attention to the dispatcher's side of the conversation. Dispatchers often use the city or state name as part of their identification call. Also, listen to mobile units, who often mention cities, townships, or states. Write down what you hear.

Once you get a few names to work with you can go to the atlas, find out if any of the names exist as cities and then look them up on a state map. Many times, if you've written down two or three place names heard over the air, you can find them in close proximity on a map. If so, you've bore-sighted your search. It might take you a few hours of listening, maybe even a few days (if you choose to take it that far), to hear enough information to track the signal to a definite area of the country. Accents help in generalizing parts of the country. Once you've targeted a state, go to your frequency guide for that area and search for any agencies operating on that particular frequency. You might discover the answer immediately. If not, go back to the scanner and keep listening for more information.

Luckily, on 42.340 MHz, we hear the dispatcher call her station "South Carolina." Transmissions in the 42 MHz range are mostly highway patrol, so we have easily identified this frequency as belonging to the South Carolina Highway Patrol. Go to the POLICE CALL frequency guide for South Carolina, if you have one, and look up this frequency, either in the sequential listing in the rear of the book or the agency by agency listing. You'll find SCHP District One operates on 42.340 MHz.

The same process works for fire, rescue, ambulance and military communications. Business transmissions are a little harder to identify, but it can be done through intense listening.

Log your catch by date, time, frequency and agency, if you'd like. Before long, you'll have a notebook full of long distance skip stations heard through the magic of the airwaves.

HERE TODAY...

A station you hear on low band today might disappear in an hour, three hours or three days. There is no way to tell how long conditions on the band will allow reception of a certain signal. Be prepared to hear more than one (often several) stations transmit-

ting on one frequency from all points of the compass on good skip days. Communications often overlap and drown out each other. Conversations ebb and flow, are lost and found in the sea of static.

I recommend a good headset, a sharp pencil and determination. It isn't hard to hear skip, but it takes patience to track its point of origin. I like to identify what I'm hearing; some folks could care less. The main point is enjoying what your scanner can bring you. Not just local communications but transmissions from all across the country and beyond.

Yes, it is possible to hear communications from other countries. I've logged Mexico, Jamaica, Central and South America. United States military, foreign security services and military, war games, range control, police, aircraft, ships, you name it, it's on low band.

Not every communication will be one you'll be able to look up in a frequency book and that is half the fun of low band listening. Some of them will remain mysteries.

800 MHz

Monitoring Trunked Systems

Open up any scanner frequency book and you'll see it...lists of 800 Megahertz frequencies, all with the letter "T" beside them. These are trunked systems. The days of sitting on one frequency and hearing all the action are fading fast. The new method is a series of frequencies, sometimes used by police, fire, rescue and public works departments simultaneously, on which conversations jump from one frequency to another in random fashion.

Impossible to monitor? Some folks think so. Check out this comment made by a Motorola engineer: "Busy systems during normal working hours used by the private sector are nearly impossible to monitor using conventional scanning. Continuous conversations can rarely be followed if users allow their repeaters to un-key between transmissions."

Or this quote from an FCC employee: "Trunked systems also have privacy benefits: because a user could be talking on any of the channels within the trunked system, unauthorized parties have a more difficult time eavesdropping on the communications of a specific trunked system user than on those of a traditional one channel conventional system user. This increased privacy is one of the key selling points of trunked systems."

I'm here to tell you that those quotes are misleading and, for the most part, wrong! Trunked systems can be easy to monitor, but you need to have patience, a quick hand and the drive to become actively involved in scanning.

800 MEGAHERTZ

Most conventional scanners are able to receive frequencies up to 512 Megahertz. For many years, 512 was the top of the line and none of the bands beyond that were accessible by off-the-shelf models. That fact is no longer true today. You can walk into any radio store and come out with a scanner that will reach all the way to 2100 Megahertz or beyond.

In all honesty, there's nothing interesting to monitor beyond about 960 MHz, so the extra band coverage goes to waste. However, 800 - 900 megahertz, a huge slice of the radio spectrum, is rich with activity from motor carrier fleets, businesses and public safety. A great many services are making the move to the 800 band because of its better reception, immunity to damaging interference and availability of channels. Most services here operate using a special system called trunking.

THE ELEPHANT'S TRUNK

Okay, there are no elephants on this band, but I couldn't resist. There are two types of trunked systems currently in use: Specialized Mobile Radio (SMR) and Sole User. We'll focus on Sole User, which is commonly used for Public Safety systems.

Conventional radio systems, such as your local fire department, probably operate on a single radio channel. No other services can use this channel and if it's busy with a transmission, a second user must wait until the channel clears before transmitting. Trunking, on the other hand, is a method by which a group of frequencies are assigned to several users. This multi-channel system is overseen by a computer. The computer microprocessor (called a Site Controller) continually scans for a free channel and assigns the next user to it when his radio is "keyed," thereby allowing the system to support several services on one group of channels.

We will try not to get too technical in our discussion of trunked systems, but knowing how the system works is half the battle in learning how to monitor it.

Trunked system repeaters operate between 851.000 - 869.000 MHz. Most systems utilize five or more channels within this range for communications. One channel (sometimes more, depending on the size of the system) is used for control. The control channel is tied directly to the Site Controller computer and is the channel on which the Site Controller "talks" to the other radios in the system. All of this talking, of course, is done in data bursts, which sound to a monitor like a loud rip-sawing buzz. You'll know it when you hear it.

When monitoring a trunked system in your area, first determine which frequencies are used by the system (check a frequency directory for public safety frequencies), enter these into your scanner, find the control channel and lock it out of your scan. Now you're ready to continue.

The control channel will change channels within the system, sometimes as often as two or three times per day. Each time the control channel rotates, unlock the old channel (which now will be used for voice transmissions) and lock out the new one.

When a radio within the system transmits, it sends a request, in the form of a short data burst, over the control channel. The data burst contains information for the computer such as: system ID, fleet ID, subfleet ID, and unit number. The Site Controller immediately tells the unit radio, via data on the control channel, to switch to a selected unused frequency. This data instruction is received by all units in the system, whether they are attempting to transmit or not. All units with the same fleet and subfleet number will then receive on the selected frequency.

If the system happens to be busy, the radio will not transmit and the Site Controller will send out a wait instruction which illuminates the "busy" indicator on the radio. When a channel becomes available, the radio unit will automatically switch to that selected channel and the user may transmit.

When a user un-keys his radio microphone, a digital disconnect code is sent to the Site Controller. The repeater hangs for a moment, awaiting other users. If no one transmits, the channel is released for other users in the system. However, if users do not let the repeater un-key, the channel will remain open. Monitors should remember that as soon as the carrier (open frequency) is dropped after a transmission, the next user's transmission will appear on another frequency in the system. For this reason,

don't use your scanner's delay feature on any of the frequencies in the system or you will miss conversations.

Public Safety trunked systems allow each fleet within the system (police, fire, rescue, public works) to be assigned a special priority level. In the event all channels are busy, those users waiting to use the system are assigned newly opened channels by the computer according to their priority level.

HINTS AND TIPS

Each radio has an emergency button, which allows the lowest priority user to be "kicked" off of a channel in favor of the unit with the emergency who activates his emergency button. This is vital, especially in the case of police or rescue units who might need immediate access to a radio channel for assistance.

Emergency buttons are occasionally pressed accidentally, opening up a channel and alerting a dispatcher, who calls the unit for confirmation. In my experience, the channel remains open with a carrier until the emergency is cancelled. This emergency opened carrier also occurs when a police dispatcher activates "emergency traffic" for a unit in a high-risk situation. To stay with the conversation, simply remain on the open frequency, but remember that dispatchers and units not involved in the emergency might be carrying on conversations on other channels in the system. You might want to occasionally scan the other channels for activity.

Each repeater channel has a corresponding input channel 45 Megahertz lower (i.e. repeater 865.000, input 820.000.) Repeater input frequencies are sometimes used to "talkaround" the repeater in simplex mode. Keep them programmed in just in case.

Occasionally, you might see a police agency use one of the repeater frequencies out of the trunked system. In this case, all units transmit and receive on the same frequency, just like a conventional one frequency system. Communications will probably be in simplex, as they were with a local police agency's undercover operation here recently.

Activity from public works and city units is often reduced at night and on weekends, when police, fire and rescue take up most of the channel space. This is often the best time to listen.

Many systems are composed of subfleets with their own sets of channels within the group. If you are hearing more than one control channel at a time, this usually indicates a subfleet. Keep careful notes on which units are heard on which frequencies and you should be able to narrow down which group of frequencies belong to which subfleet. It's common for subfleets to use other frequencies in the system. One of my local police departments' 800 Megahertz system uses a citywide channel on which all units in the system can communicate, from police/fire/EMS to public works and park rangers.

OPENING THE TRUNK

No matter how many channels are active in the system you are attempting to monitor, it can be done. However, don't expect to sit back and listen trouble-free, as you are no doubt used to doing with other frequencies. 800 Megahertz requires a finger on the scan button and your full attention. Success can be achieved and you may just find that "fully interactive monitoring" is more fun that you imagined.

Offbeat Stuff

Monitoring The Odd And Unknown

There is a world full of strange monitoring targets out there on the scannerbands. From the low frequencies to the high, odd transmitters operate, allowing a scanner listener to step into an imaginary pair of khaki's and go off on safari through an audio land of the weird and unknown.

Some of things you hear might make you feel like you're out in the bush of Africa, but everything has a logical explanation, even if we're not quite sure what it is! If you thought police and fire communications were the normal fare of the scanner radio, wait until you try out some of the frequencies in this chapter. What you hear will surprise you. The electromagnetic spectrum is alive with the sounds of many different devices all broadcasting sounds you can hear on your scanner.

"Welcome to..."

I was scanning the 35 MHz band, looking for signals skipping in from other parts of the country, when the scanner locked up on 35.020 MHz. It appeared to be an open channel and hearing nothing, I was about to continue the search, when a voice said: "Welcome to McDonald's, may I take your order?"

What?! McDonald's? On a scanner? Believe it or not, I was receiving transmissions from the order window of the McDonald's restaurant a little over a mile from my home. Order taking crews wear low powered wireless headset transmitter/receivers. Communications between the headset and the order speaker mounted in the parking lot are audible on scanner frequencies.

McDonald's isn't the only order window transmissions you can hear. Almost every restaurant with a drive thru window uses two-way low powered radios to transmit the voices back and forth. There are exceptions, such as when the order grille speaker is "hard-wired" into the restaurant. Your clue that radio communications (instead of intercoms) are being used is usually the presence of some type of wireless headset being worn by the employees. If they are speaking into a microphone attached to the desk next to the cash register, chances are it's a hard-wired system and you won't be able to hear anything.

I must admit that I haven't found fast food communications to be very exciting — unless you are counting the number of hamburgers sold, it's a tedious endeavor. However, some folks find it fun and say that during slow periods such as early morning or late at night, the communications can be hilarious and highly enlightening. Some have even said that you might not want to eat at fast food restaurants after you listen to "behind-the-scenes" chatter. I'll leave that judgement up to you...

Try the following frequencies for fast food order window transmissions. Most are used nationwide and one or more should be active in your area. Bear in mind that transmissions are low powered and reception depends on your location, antenna, distance and atmospheric conditions.

McDonald's	35.020	154.600	154.570	
	33.150	158.895		
Burger King	460.8875			
Kentucky Fried Chicken	462.7625			
Taco Bell	33.400			
Various Users	33.140	35.060	151.490	151.625
	151.895	154.515	154.570	154.600
	157.600	157.620	170.245	170.305
	171.105	457.5375	457.5875	461.3125
	464.3125	464.1125	464.1625	464.3375
	467.825	467.850	469.3375	

What's Bugging You?

Most of us have seen one or more of those reality-based television series that follow law enforcement agencies around on undercover operations. A detective parks his car a safe distance away and sends in an undercover officer equipped with a body microphone which transmits all of the audio of the dirty deal back to the detective in his car.

Local, state and federal law enforcement agencies routinely use bugging devices in pursuit of criminal activities. Most of the audio from these devices are easily intercepted using a standard scanner radio.

FM band bugs are common and operate in "dead spots" on the FM broadcast band. If your scanner doesn't receive 88.000 -108.000 MHz, try tuning an FM stereo through the band, always concentrating on the dead areas between stations, and especially the low and high ends of the band. You will want to ensure that the stereo switch is off, allowing FM reception without stereo sound. This will enable you to hear the static between stations and possibly catch a bugging device. Remember that bugs are low powered with transmission distances of one quarter mile or less quite common.

Up on the VHF/UHF bands is where the search for bugs takes on a life of its own. Everyone from local police to the Federal Bureau of Investigation has been heard using bugging devices on these bands. Common ranges to check are 148.000 - 150.000, 165.000 - 175.000, 175.000 - 200.000 and 450.000 - 470.000 MHz. Also, don't neglect low band transmitters between 45.000 and 60.000 MHz.

How do you know when you are hearing a bug? You'll know! There might be voices of normal conversation, or dead silence. If you are unsure, check to see if the frequency falls between the bands listed previously. Listen at different times of day to see if the frequency has any voice components or is just "open" (which might indicate that this isn't a bug at all, but a "birdie," an open frequency internally generated by your scanner's oscillator.) Sooner or later, you'll hear activity. A little listening should clue you in to what's going on.

Police departments occasionally engage in bugging activities and though these bug transmissions may fall within the ranges described, don't forget to scan the law

enforcement bands. Police sometimes use tactical or undercover frequencies for bugging.

Some bugging intercepts are listed below. They are not, by far, the only frequencies used, but they have seen use for body and room surveillance transmitters. 40.220 MHz is used in many areas for "bumper beeper" vehicle-mounted tracking devices.

40.220	177.600
154.695	181.600
154.995	183.600
149.000	186.600
149.350	186.600
165.9125	190.600
167.3375	192.600
167.3425	195.600
167.4875	199.600
168.0115	457.5625
169.200	457.7875
169.225	
171.450	
172.000	
172.200	
173.3375	
174.600	

When is a bug not a bug? When it's a baby monitor...

Nursery Rhymes

Between 49.000 and 50.000 Megahertz lies a fertile band of frequencies no scanner monitor should overlook. Baby monitors, those low powered devices parents often place next to their baby's cribs so that they can hear when junior is awake, provide the cheapest bug money can buy.

In the early days of my monitoring, I came across what sounded like live conversations on 49.875 Megahertz. There were "baby sounds," voices, clanging of pots and pans, children, door bells, phones ringing. I was sure I had found a bug. I wonder if my neighbor (whose voice I had heard on the frequency) knows that she's bugged, I asked myself. It wasn't until I checked a frequency assignment listing that I discovered what I was hearing was a garden variety baby monitor, available in any store. What it provided was a twenty four hour a day audio window into my neighbors' home.

Some of what you will hear via baby monitors will be downright embarrassing, which is why I don't venture into this band too often. Folks often keep these monitors on day and night, broadcasting sounds from the entire household. It's an eye-opener that will make you laugh, cry and blush.

The following frequencies are commonly used by baby monitor devices nationwide. Bear in mind that the handset portion of cordless telephones operate in this band, on some of the same frequencies also, as well as security monitors and wireless intercoms:

49.670	49.770	49.830	49.845	49.860
49.875	49.890	49.930	49.970	49.990

As a general rule, scan between 49.000 and 50.000 megahertz, note any active frequencies and cross check them against those listed here. Some folks claim that there is no end to the entertainment value of baby monitor listening and they make it a serious part of their hobby. Tune in and see for yourself.

"Red Leader to Base..."

The personal walkie-talkie has long been the basis of great childhood adventures from the living room to the backyard to the empty field on the corner. Kids of all ages can spend hours with a pair of transceivers and a dose of imagination. Today's personal walkie-talkies operate on frequencies between 46.000 - 47.000 and 49.000 - 50.000 Megahertz, require no license and are used not only by children, but by hikers, campers, bikers and even road construction crews!

I once listened to a pair of hunters tracking some out of season game using walkie-talkies on 49.890 MHz. They were very interested in bagging their catch and departing before law enforcement showed up. To my delight, three hours later they had failed to fire a single shot and ended up leaving without their illegally gotten prize.

Local hikers have long used 49 Megahertz walkie-talkies to keep in touch and more than once have been saved from becoming lost through this form two-way communication.

You never know what you will find in the 49 Megahertz band or who will be on the air, but the easy availability of personal walkie-talkies that transmit here make it a good target for scanner monitors. Once again, these are low powered devices and range is limited. They are sandwiched in with other devices like baby monitors and cordless telephones, so you will have to determine carefully what you're hearing. Tune in and see if you can track down some interesting transmissions.

"Doctor Collins, call Radiology..."

Undoubtedly, as you have scanned the bands, your scanner has stopped on frequencies displaying odd tones. These tones range from beeps, whistles and hoots to some sounds that can't be described with words. Messages from aliens? Not quite. Welcome to the world of tone and voice paging.

It's easy to tell if what you are monitoring is a pager. The long string of tones and noises, sometimes lasting one minute or more, will be your first clue. If this is a voice paging system, you will at some point hear the voice message broadcast. Tone-only systems are just that, tone-only with no voice components, and are extremely difficult on the eardrums.

Pagers are, admittedly, some of the stranger fare to be found on the scannerbands. No matter how hard you try to avoid them though, there they are, cropping up in almost every imaginable place on the VHF/UHF bands. Monitoring them can be interesting and some listeners choose to monitor specific agencies, such as police department paging systems, hospital pagers, hotel pagers, etc.

A local hospital maintains a paging system on 453.075 MHz. By monitoring this, I am able to hear physicians, nurses and departments being paged, short paging messages and all sorts of interesting information being relayed.

A very high-class resort hotel in my area operates a paging system on 154.625 MHz, a strange frequency for paging activity to be found on. This frequency is probably licensed to the hotel and they utilize it for paging purposes.

Check the following frequencies for paging activity:

35.200 - 35.680
43.200 - 43.680
152.510 - 152.840
157.000 - 157.770
452.000 - 453.400
454.000 - 454.600
462.750 - 462.930
930.000 - 932.000
952.000 - 960.000

Remember that not all paging is done with voice components, so scan carefully and make notes of what you hear. You should be able to determine special paging systems such as doctor's exchanges and businesses just by concentrated listening.

Airborne beeps and blats

If you are looking for some really strange listening — and I mean stranger than some of the stuff we've been discussing in this chapter — try some of the following.

75.000 MHz is the frequency commonly used nationwide by aircraft navigation marker beacons. These exist near airports along the ILS (Instrument Landing System) course leading to the runway. They are designed to alert pilots, by means of a visual light in the airplane and an audio tone, to various checkpoints along the final approach to the runway.

Monitors will hear the following tones and can identify which beacon along the course they are hearing. Three lights are in the cockpit, each triggered by a separate audio tone:

Blue - Outer Marker, Intercept point is 4 to 7 Miles downrange from runway. Two 400 Hz audible dashes per second.

Amber - Middle Marker, 3500 Feet downrange from runway. 1300 Hz audible dots and dashes broadcast 95 times a minute.

White - Inner Marker, 3000 Feet downrange from runway. Six 3000 Hz audible dots per second.

TACAN, a commonly used military radio navigation system has 126 "X" and 126 "Y" channels. Normally only X channels are used, unless the system is crowded. TACAN frequencies are tied to VOR (Very High Omni-directional Receiver) navigation frequencies. Pulse widths are 3.5 microseconds. The aircraft transmitter is said to sound like a Top Fuel Dragster or Funny Car when searching for lock-on.

All frequencies in Megahertz:

Ch.	VOR	Air	Ground
17X	108.00	1041	978
17Y	108.05	1041	1104
18X	108.10	1042	979
18Y	108.15	1042	1105
19X	108.20	1043	980
19Y	108.25	1043	1106
29Y	N/A	1053	1116
58X	112.10	1082	1019
58Y	112.15	1082	1145
59X	112.20	1083	1020
59Y	112.25	1083	1146
70X	112.30	1094	1157
70Y	112.35	1094	1031
92Y	N/A	1116	1053
126X	117.90	1150	1213
126Y	117.95	1150	1087

29Y and 92Y are said to be favorites for military air refueling (air to air) Check the heavens if you hear these frequencies active, you never know what's flying overhead.

Air Traffic Control Radar Beacon System (ATCRBS - "At Crabs") used to identify aircraft radar blips on air traffic controller radar bright displays operate on the following frequencies:

1030 MHz	Ground Interrogations to Airborne Transponder
1090 MHz	Airborne Transponder Replies to Ground

There are currently five interrogation modes in use:

Mode 1:	2 pulses spaced 3 microseconds
Mode 2:	2 pulses spaced 5 microseconds
Mode 3/A:	2 pulses spaced 8 microseconds
Mode 4:	Encrypted, military identification friend/foe
Mode C:	2 pulses spaced 21 microseconds

A third pulse is also included in all modes (except 4) at two microseconds from the first. This is the sidelobe pulse. If it is within 6 dB of the first pulse (or greater) the transponder doesn't reply (as it has detected an antenna sidelobe). Pulse widths are .8 microseconds.

The reply is two framing pulses spaced 20.3 microseconds apart, with 13 code pulses (0000 - 7777 Octal). A fourth pulse (called SPI pulse-Special Position Identifier) is used to identify an aircraft's position when the pilot is asked by a controller to "Squawk

Ident." It occurs 4.35 microseconds after the last framing pulse and lasts for 20 seconds, about 2 scans of a long range radar. Pulse widths are .45 microseconds.

Often I can tell if an aircraft is approaching my location by monitoring the tones I hear on 1090.000 MHz. A strange pursuit, but it can be entertaining when you are looking for something different.

Itinerants

Webster's Dictionary defines an "itinerant" as one who wanders from place to place, and that's fairly close to the meaning behind itinerant frequencies.

There are certain frequencies nationwide that see use by many small businesses and agencies that cannot afford or do not wish to license a special frequency for their operations. They therefore operate on "generic" frequencies. Often called "color dot" frequencies, because of the colored dot that often appears on the radio case and defines which frequency it operates on, these frequencies offer many interesting monitoring catches.

Red	151.625	Green	154.600
Blue	154.570	Brown	464.500
Yellow	464.550	White	462.575

A local wholesale store uses Motorola handheld radios operating on the Green channel for communications between employees, stockers, parking lot personnel, security and management. I have also heard surveyors and construction crews using the Blue and Brown channels for intercommunication, traffic control and equipment movements.

Even drug traffickers and dealers sometimes use itinerants for communications! Honest, I've heard them myself. You never know what will pop up on itinerant frequencies. It's a good idea to save some memory space in your scanner, enter these frequencies in and scan them often for activity.

Television on your scanner

Once, on a rather rainy afternoon, I was idly searching through the bands, when I heard what appeared to be distorted television audio on 87.75 MHz. The PRO-2006 that I use has the ability to manually switch to Wideband FM mode (WBFM) and I used that feature to clear up the audio on this frequency. As soon I did, I was able to hear a very fine audio signal from television channel six!

The little box with knobs had surprised me again. Television stations broadcast very wide signals, transmitting picture, color and sound components over radio frequencies. The picture and color frequencies sound like a loud buzzing hash, but the audio frequencies are real gems.

U.S. Television Broadcast Sound Channels

2 ..... 59.75 MHz	3 ..... 65.75 MHz	4 ..... 71.75
5 ..... 81.75 MHz	6 ..... 87.75 MHz	7 ..... 179.75
8 ..... 185.75 MHz	9 ..... 191.75 MHz	10 ..... 197.75
11 ..... 203.75 MHz	12 ..... 209.75 MHz	13 ..... 215.75
14 ..... 475.75 MHz	15 ..... 481.75 MHz	16 ..... 487.75
17 ..... 493.75 MHz	18 ..... 499.75 MHz	19 ..... 505.75
20 ..... 511.75 MHz	21 ..... 517.75 MHz	22 ..... 523.75
23 ..... 529.75 MHz	24 ..... 535.75 MHz	25 ..... 541.75
26 ..... 547.75 MHz	27 ..... 553.75 MHz	28 ..... 559.75
29 ..... 565.75 MHz	30 ..... 571.75 MHz	31 ..... 577.75
32 ..... 583.75 MHz	33 ..... 589.75 MHz	34 ..... 595.75
35 ..... 601.75 MHz	36 ..... 607.75 MHz	37 ..... 613.75
38 ..... 619.75 MHz	39 ..... 625.75 MHz	40 ..... 631.75
41 ..... 637.75 MHz	42 ..... 643.75 MHz	43 ..... 649.75
44 ..... 655.75 MHz	45 ..... 661.75 MHz	46 ..... 667.75
47 ..... 673.75 MHz	48 ..... 679.75 MHz	49 ..... 685.75
50 ..... 691.75 MHz	51 ..... 697.75 MHz	52 ..... 703.75
53 ..... 709.75 MHz	54 ..... 715.75 MHz	55 ..... 721.75
56 ..... 727.75 MHz	57 ..... 733.75 MHz	58 ..... 739.75
59 ..... 745.75 MHz	60 ..... 751.75 MHz	61 ..... 757.75
62 ..... 763.75 MHz	63 ..... 769.75 MHz	64 ..... 775.75
65 ..... 781.75 MHz	66 ..... 787.75 MHz	67 ..... 793.75
68 ..... 799.75 MHz	69 ..... 805.75 MHz	70 ..... 811.75
71 ..... 817.75 MHz	72 ..... 823.75 MHz	73 ..... 829.75
74 ..... 835.75 MHz	75 ..... 841.75 MHz	76 ..... 847.75
77 ..... 853.75 MHz	78 ..... 859.75 MHz	79 ..... 865.75
80 ..... 871.75 MHz	81 ..... 877.75 MHz	82 ..... 883.75
83 ..... 889.75 MHz	84 ..... 895.75 MHz	

As you can see, there is no end to the weird and wonderful things you can tune into on your scanner. My best advice is to explore everything from 30 MHz all the way up to your scanners' limit, be it 512, 960 or 1300 MHz. And don't scan it just once, decide that there is nothing of interest, and move on. Come back again and again, re-scan swaths of different bands. Frequencies that are inactive today may be active tomorrow.

SCANNING SPACE

Monitoring The Final Frontier

The satellite tracking program is up and running on the computer screen, displaying a world map overlaid with the track of NOAA 11. The National Oceanic and Atmospheric Administration's space satellite is due to pop over my listening horizon at any moment. I have the scanner tuned to NOAA 11's radio frequency and closely watch the computer icon move along the course lines on the screen.

An information box at the bottom of the screen tells me orbital information such as altitude, azimuth, and distance of the satellite from my location. NOAA 11's track takes it across the world and back, but for a few minutes each day it passes over me.

A signal breaks the squelch on the scanner....beep, beep, beep.....and grows progressively louder over the next few minutes. NOAA 11 is right on time and on target. The beeps signal data that is being relayed down, weather photos which I would be able to decode if my computer and scanner were connected. As it is, I must be content with tracking the satellite and not its pictures.

The beeps fade into the background static as the satellite rotates out of range, some one hundred sixty three miles above me. For a little while, at least, I have heard sounds from space. Meaningless beeps, perhaps....but for someone interested in satellites, orbits and space, a real prize of an audio catch.

HEARING SATELLITES

There are many different types of satellites orbiting our world twenty four hours a day, everything from weather sats to military spy sats. Some, like weather satellites, can be tapped into by connecting scanner to computer, but that is beyond the scope of this book. We're concerned with the satellites you can hear simply by turning on your scanner and listening.

For best results, experts tell me it's wise to have an outdoor antenna that can be rotated in both altitude and azimuth, allowing a monitor to "beam in" on the orbiting birds. Any scanner that tunes the correct frequency ranges and has an adjustable mode control (FM, NBFM, AM, etc.) will work. Regardless of technicalities, try listening with whatever equipment you have and see what the results are.

WEATHER SATELLITES

The most common first catches for monitors are non-voice weather satellites. Both NOAA and the Russians maintain orbiting satellites for the relay of weather data and photos back to earth. The telemetry from these birds can be heard by scanning between 136.000 - 138.000 MHz.

Have patience. The listening windows are sometimes short, depending on how long the satellite remains above your local horizon. Try often to find the times of passage. What you'll hear will be a series of beeps, rolling tones, or ticking-clock sounds. You'll know it when you hear it. Keep your squelch control set as low as possible and record the time you first heard the satellite, and for how long.

It's not uncommon for signals to "up-shift" or "down-shift" in frequency. For instance, if signals begin on 137.500 MHz, they might up-shift slowly to 137.550 MHz as the satellite moves. This is due to the Doppler effect incurred when the satellite moves toward you and away from you. An up-shifted signal means the satellite is approaching your position, down-shifted indicates a satellite moving away from you.

Weather Satellite Frequencies

Some of the more common weather satellites you may hear on your scanner are:

137.500 NOAA Series Wx - NOAA 10/12
137.620 NOAA Series Wx - NOAA 9/11
137.770 NOAA Series Wx
137.850 Soviet Meteor - 2-20, 3-3 or 3-4

SATCOM SATELLITES

The United States military forces commonly use satellite transmissions to communicate with assets worldwide. AFSATCOM (Air Force Satellite Communications System,) for instance, sees use by the US Air Force National Command Authority for strategic forces command and control. Much of what is heard via Air Force and Navy satellites is encoded or scrambled, however it is possible to find some voice communications.

Satcom Satellite Frequencies

248.900 MARISAT NBFM mode voice
261.700 FLTSATCOM NBFM mode voice
262.550 FLTSATCOM voice/data
262.950 FLTSATCOM NBFM mode voice
264.900 MARISAT NBFM mode voice
269.475 AFSATCOM NBFM mode voice
269.550 AFSATCOM WBFM mode voice
288.000 FLTSATCOM voice/data
295.075 AFSATCOM WBFM mode voice
305.550 AFSATCOM WBFM mode voice

Scan 240.000 - 270.000 MHz for additional satcom activity.

RUSSIAN SATELLITES

My first introduction to Soviet satellites, and indeed satellites in general, was through an article in Air and Space -Smithsonian magazine (Satellite Sleuths, June/July 1990) Here I learned of the Kettering Group, an informal amateur team of people dedi-

cated to tracking Soviet sats with table-top equipment and lots of patience. They say each satellite has a distinctive pattern of beeps and whistles and it is these tones that they listen for during long day and night vigils beside the radio.

I was inspired by this story, and went hunting. My first (and only) Soviet satellite log was a Meteor weather bird, but it was enough to whet my appetite for this strange hobby known as satellite tracking.

Russian Satellite Frequencies

143.625	MIR Space Station (FM)
149.910	CIS Military NAVSAT data
149.940	CIS Military NAVSAT data
149.940	CIS Military NAVSAT data
150.000	CIS Civilian NAVSAT data
150.030	CIS Military FM mode voice/data
166.000	CIS Manned Space Channel data/voice
231.500	CIS Unmanned Military Spacecraft NBFM mode data
232.000	CIS Military Spy satellite data
239.500	CIS Science satellite data
240.000	CIS Unmanned Spacecraft beacon
247.475	CIS Spy satellites data
248.000	CIS Spy Photo Recon satellite data
399.760	CIS Military satellite NBFM mode voice/data
399.840	CIS Military satellite NBFM mode voice
399.920	CIS Military satellite beacon
400.000	CIS Military satellite beacon
400.080	CIS Military satellite NBFM mode voice/data

THE SPACE SHUTTLE

Monitoring the Final Frontier

My scanner has always taken me many places at the touch of a series of keyboard buttons...from ground level to as far away as the blackness of space.

I have heard the pulse-pounding pre-launch procedures on the launch pad at Kennedy Space Center, the roar of lift-off rattling the scanner speaker, the words "We have achieved orbital insertion," the fascinating daily chores of astronauts at work in space: repairing wayward satellites on spacewalks, conducting experiments, dodging "space junk" and marvelling at the earth so far below. I have even heard the last words of the CHALLENGER crew seconds before their vehicle exploded.

All this and more...the unplanned occurrences, the small talk between Mission Control and the orbiter, the laughs, the seriousness. All live and real on a scanner, far removed from what we see on day's end newscasts. There's nothing like it and it's just a key-press away.

HEARING THE SHUTTLE

NASA's four main orbiters use sophisticated S- and Ku-band radios for communications. Operating in the 1700 - 2300 MHz and 15.250 - 17.250 GHz bands, these voice communications are usually multiplexed (mux'ed or combined) with data transmissions

so that they are unreadable on conventional scanners.

Don't let this daunt you! There are other ways to hear the shuttle. UHF frequencies are used during spacewalks, and after re-entry, during approach and landing modes. Try direct downlink from the shuttle on 296.8 MHz (AM mode), backup frequency of 259.7 MHz (AM mode) and 279.000 MHz for EVA's. Remember that communications on these frequencies are most active during EVA's (Extra Vehicular Activities) and during landing phases when the shuttle is above your local horizon (line of sight.)

I regularly monitor the shuttle landing at Edwards Air Force Base, approximately 150 miles away, on these UHF frequencies. The listening window is very short, maybe two minutes as the shuttle crosses the coastline.

I recommend a shuttle tracking computer program such as STSORBIT or TRAKSAT, by which you can follow the shuttle's course over the earth and know when to listen for possible communications. It helps to know the times of EVA's and landings. In all cases, start listening about fifteen minutes before the event. Try tape recording the transmissions for later playback.

The space shuttle orbiter's main landing sites are Kennedy Space Center, Cape Canaveral, Florida; Vandenberg Air Force Base, Lompoc, California; and Edwards Air Force Base, California. If you live near any of these sites then you have an excellent chance of hearing direct communications on UHF frequencies.

AMATEUR RADIO REBROADCASTS

No matter where in the United States you live, you should always be able to tune into shuttle communications via Amateur Radio rebroadcasts. Many ham radio operators retransmit shuttle audio through an agreement with NASA and the Johnson Space Flight Center.

You should search for rebroadcasts on the following bands: 144.000 - 148.000 MHz and 420.000 - 450.000 MHz. Be prepared to hear not only shuttle transmissions, but also ham operators, who often transmit during silent periods when the shuttle isn't communicating (and sometimes when they are!)

Begin searching for Amateur Radio rebroadcasts two hours prior to launch, when pre-launch activities may be heard. Most stations continue to broadcast throughout the mission and after the landing. Note any frequencies you find active with shuttle communications and keep this list handy for each mission. Frequencies will change, with some going inactive and others taking up the broadcasts from mission to mission. Always scan the amateur bands for new frequenciess on each mission.

Of five stations broadcasting STS-45 in my area, two had better audio than the others. Hopefully, more than one outlet will broadcast in your area, allowing you to have a choice of the clearest frequency.

Almost all shuttle flight communications are available for rebroadcast by Amateur Radio operators. Department of Defense (DOD) missions are usually classified, and communications are not rebroadcast for security reasons.

TERMINOLOGY - LANGUAGE OF THE STARS

Much of what is spoken of on air to ground channels during shuttle missions is scientific or technical information which defines definition by the general public. Luck-

ily, the Public Information Officer (PIO) serves as the Voice of Mission Control during missions, explaining what is happening between transmissions.

Here are some abbreviations to get you started:

ADI	Attitude Direction Indicator
ADP	Air Data Probe
AMI	Alpha/Mach Indicator
AOS	Acquisition of Signal
APU	Auxiliary Power Unit
AVVI	Altitude/Vertical Velocity Indicator
BFS	Back-up Flight Computer System
CDR	Shuttle Commander
COLA	Collision Avoidance
CIC	Crew Interface Coordinator
CRT	Cathode Ray Tube
CSS	Control Stick Steering
CTA	Contingency Target Acquisition
DCM	Displays and Controls Module
DDU	Dedicated Display Unit
DOD	Department of Defense
DTO	Detailed Test Objectives
EMU	Extravehicular Mobility Unit
ET	External Tank
EVA	Extra Vehicular Activity
GNC	Guidance and Navigation Control
MS-2	Mission Specialist Two
NTA	NASA (Shuttle) Training Aircraft (also STA)
OAD	Orbital Attitude Display
OIS	Orbiter Intercom System
OMS	Orbital Maneuvering System (pronounced "ohms")
PLBD	Payload Bay Doors
PLT	Shuttle Pilot
PS-1	Payload Specialist One
PS-2	Payload Specialist Two
POC	Payload Operations Control
RCS	Reaction Control System
SRB	Solid Rocket Booster
SSME	Space Shuttle Main Engines
TAEM	Terminal Area Energy Management
TAGS	Text and Graphics System
TDRS	Tracking and Data Relay Satellites

I highly recommend *The Space Shuttle Operator's Manual* by Kerry Mark Joels, Gregory P. Kennedy and David Larkin (1982, Ballentine Books) This book is all you'll need to get up and flying from ground level.

The Space Shuttle is perhaps the greatest aeronautical achievement of our cen-

tury. The ability to take a human crew, send it off like a rocket into space, orbit it and return it to earth to land on a runway like a conventional airplane is awe-inspiring.

Coverage of shuttle operations have lapsed greatly since the first flight in 1981. It saw a brief resurgence after the CHALLENGER disaster in 1986, but the novelty quickly wore off. The truth is, shuttle flights are anything but routine, as those in the know will be quick to point out. Launching a 4.4 million pound bird into space and bringing it back is a monumental task.

Scanner listeners who monitor shuttle flights will learn of the complexity of space operations and come to respect and admire those whose job it is to go into space.

Emergency and Disaster Monitoring

Keeping Informed When It Counts

A scanner can provide hours of uninterrupted entertainment, as preceding chapters in this book have demonstrated. Literally dozens of agencies can be monitored, some twenty four hours a day. But, when it comes down to an emergency situation, your scanner becomes much more than a source of entertainment...it becomes a vital tool.

I live in an area of moderate flood activity during winter. There have been a few times when evacuation has been necessary because of rising flood waters. City construction has improved much of the problem in the past few years, but I still keep an ear to the scanner during rainstorms. Just for safety's sake, the scanner is my link to information.

During the last winter storm, the streets were flooded and rain continued to pour down relentlessly. Sirens howled and the scanner was alive with endless police, fire and rescue calls of people trapped in houses, in vehicles, streets that needed closing, traffic that was backing up. The city was in turmoil.

Two banks of my scanner are designated emergency banks for just a situation as this. Punching up these two banks keeps me well informed: sheriff's department, fire department, public works, gas, power, water, street department, cable TV, news media frequencies, aeromedical evacuation teams.

Because my scanner is set up to monitor emergencies well in advance of a situation, I never miss out on the action by being unprepared. And I always know what the best escape routes are and when it's time to act. You can do the same. Who knows, someday being informed may save your life.

DETERMINING WHAT TO MONITOR

In my book, an emergency is anything from a major fire to a nuclear attack. Your definition may differ, but I set up my scanner so that I'm ready for nearly anything that happens, from the "mundane" to the "extreme."

If you are like me, you are most concerned with emergencies or disasters that occur close to home. This means frequencies that belong to local agencies that could be involved in an emergency must be a part of your "emergency scan bank."

First of all, include your local police department's dispatch frequency. Every police officer receives his directions from the dispatcher and this frequency is where you are most likely to hear first transmissions about an emergency.

Include any police tactical or car to car frequencies next, along with any area-wide intersystem or mutual aid frequencies. These see quite a bit of radio traffic during emergencies, and are often the source of information not heard elsewhere. A hazardous materials spill a mile from my house was discussed among two officers on a tactical frequency. From their conversation, I learned the extent of the accident and whether the materials were presenting a danger to the surrounding area.

Next comes fire department dispatch, and any tactical or fireground frequencies in use in your area. Fire often gets first call in an emergency and you don't want to miss any information.

Hospital to ambulance frequencies should be included in your scan. My local fire department paramedic teams establish contact with the nearest trauma center in the event of an emergency situation and vital patient information is passed. A very informative set of frequencies. (See the Emergency Medical chapter.)

Be sure to include any frequencies specifically set up to handle emergency transmissions. In California, CALCORD (156.075 MHz) is designated for this and is a prime target. Also, the local Disaster Preparedness Office or Office of Emergency Management will maintain a radio system (call your nearest office for details.)

American Red Cross frequencies are active during major emergencies and disasters. Search 47.000 - 48.000 MHz for active channels in your area and program them in. They will be a source of information about relief and rescue efforts.

In the event of serious emergencies, where government assistance is requested, FEMA (Federal Emergency Management Agency) jumps into action. Listen for them.

27.650	141.950	166.225
27.850	142.025	167.975
27.900	142.350	168.350
138.225	142.375	169.250
138.575	142.400	169.600
139.100	142.425	169.875
139.825	142.925	170.200
139.450	142.950	173.1875
139.225	142.975	409.125
139.950	143.000	
140.025	143.250	
140.900	143.600	
141.725	163.100	
141.875	164.8625	
141.875	165.6625	

164.8625 and 165.6625 are reported to be used by FEMA handheld radios nationwide.

Vital frequencies are local power, gas and water companies. Any potential or actual problems can be monitored, as well as repair progress. This becomes important when you are monitoring in the dark due to a power failure!

Public works frequencies are important during floods, fires and local emergencies where streets or public facilities are involved. Monitoring my local city crews, I'm al-

ways up to date on which streets are usable and which are closed down. You'll need this information if evacuation becomes necessary.

The News Media, for all the grief we give them, are always up on what is happening in the community. Keep an ear to their frequencies for advance word about emergencies and additional information before it hits the TV or the radio. Chatter on these channels can often lead you to other places to monitor the action on the dial.

Site Specific

Certain emergencies involve localized areas, such as power plants, fuel facilities, oil refineries, transportation centers and major buildings. Are there any nuclear power plants in your area? Find out and search out their frequencies for inclusion in your scan. If an oil refinery nearby explodes into a raging fire, do you know which frequencies they use for security, fire fighting and plant operations? Find out!

Make it a point to find out any major facilities near your location. If a disaster happens or involves one of them, you'll need to monitor actual on-scene company frequencies for details.

The San Onofre Nuclear Power Plant is in Oceanside, California. I'm well out of the danger zone should a leak occur here, but you'd better believe I know where to listen if something happens. The disaster doesn't have to affect you to be an important monitoring target.

You can tailor make your emergency scan for the area you live in by including special frequencies. For instance, do you live near a military base? Program in their fire-fighting, medevac, explosives ordnance disposal and crash frequencies. Live near an airport? Program in security, fire, crash and rescue. Near an ocean, lake or waterway? Try Coast Guard, Harbor Patrol, water rescue, lifeguards, police dive teams. I keep the California Department of Forestry dispatch and aerial fire-fighting frequencies programmed into my emergency scan bank. During fire season, I am able to track wildfires which threaten my area.

WHEN TO LISTEN

If I could forecast emergencies, I wouldn't be writing this book. Since I can't predict when something will happen, I'll have to settle for giving you some listening tips which might help you catch the action.

Inclement weather always causes problems. Keep an ear to the National Weather Service's band of frequencies (162.000 -163.000 MHz) for advance warning of hurricanes, tornadoes, floods, etc. The Boys at the Bureau often have a good handle on weather; if they put out a watch or warning, warm up the scanner and go to it!

Include your emergency bank of frequencies in your regular everyday scan; you might hear something break here before anywhere else. The same goes for News Media frequencies. These folks are well informed and their information will reach you before it becomes publicity available.

Know your frequency bands. If you get a hint that something is afoot, you might be able to track down the action based solely on your knowledge of the scanner. I once heard a sheriff's deputy report backed up traffic which he believed might be due to a train stuck on the tracks. I immediately scanned the rail frequency band and hit upon a train "road" frequency, where engineers were discussing the problem. If it had been an

emergency situation, I would have come across interesting and useful information here.

Keep a list of emergency frequencies near your scanner, especially those that aren't a part of your regular scan banks. You won't want to search wildly for them when push comes to shove, you'll want them at hand.

The best advice of all: anytime you're in the room with a scanner, turn it on. You never know what you will hear or when you will hear it!

EQUIPMENT FOR EMERGENCY MONITORING

It goes without saying that a properly programmed scanner is your best equipment, but there are a few other things I've found handy. Here's my Emergency Monitoring Kit:

- Handheld radio - you'll need it when the power goes out or you leave the house. Have the right frequencies already programmed in and ready to go.
- Extra batteries - for the handheld, when you're not near a wall outlet. Be prepared! You might be without AC power for a long time. Don't let your primary source of information go dead.
- Replacement antenna - for the handheld, in case you lose one or it suffers damage. A long piece of copper wire will do the trick for worst case listening.
- Flashlight - for obvious reasons.
- Paper, pencil and map - for writing down new frequencies, and information and tracking the emergency.
- An emergency frequency list - preferably one that will fit in a pocket to be taken along.
- Patience and a quick hand - for following all the transmissions!

BIG TROUBLE

Local emergencies and disasters, while the most threatening to us, are often overshadowed by the possibility of major disasters. Take nuclear war, for instance. Folks keep telling us the cold war is over, but I'll keep the US Strategic Command's two frequencies in my scanner anyway, thank you. 311.000 and 321.000 MHz are primary and secondary channels for USSTRATCOM. If war occurs, nuclear or otherwise, you'll hear activity here first.

The Nuclear Emergency Search Team (NEST) can be found by searching a range between 163.000 - 173.000.

Likewise, NORAD (North American Aerospace Defense Command) is a good target on 228.7, 233.6, 238.7, 273.4, 278.4, 292.8, 318.4, 338.1, 364.2 and 254.2. Airborne intercepts of invading aircraft will be handled here.

NOAA Hurricane Hunter aircraft can be monitored on 304.8, 122.9, 122.925 and 123.45.

You get the idea. Your emergency banks can contain as few or as many frequencies as you deem necessary. Keep it local or extend it to monitor statewide or nationwide disasters. Set up your scan in the way the best suits your monitoring. Tailor it to your area and don't be afraid to change frequencies when you discover new or obsolete ones.

Keeping informed when it counts is the key and the whole idea behind emergency scan banks. I hope you'll never have to use them, but when something does happen, you'll be the best informed person in town.

GPC	General Purpose Computer
HSI	Horizontal Situation Indicator
IMU	Inertial Measurement Unit
INCO	Integrated Communications Officer
IPS	Instrument Pointing System
IUS	Inertial Upper Stage
LCC	Launch Control Center
LOS	Loss of Signal
MET	Mission Elapsed Time
MMU	Manned Maneuvering Unit
MPC	Manual Pointing Control
MS-1	Mission Specialist One

In Closing

I hear voices every day from the small gray scanner on my desk. Voices plucked from the ether by an ever-vigilant antenna, passed down through an RG58 coaxial cable, routed through a microprocessor and numerous diodes to a speaker where the voices emerge as words I can understand. It's an amazing process, intercepting radio communications, tapping into the sounds floating in the sky. Hundreds of frequencies entertain me, enlighten me and occasionally rivet me to the speaker as I tune in on real life.

This book was written to help you intercept the voices freely circling our heads and make sense of what they are saying. It was written to enrich your listening and urge you to seek out those elusive frequencies, those strange transmissions, those unknown frequencies that make scanning such an absorbing hobby. Each chapter is a primer on a different facet of scanning and is not intended to be a complete treatment of the subjects. As you listen you will fill in the blanks and add to your knowledge of different radio services and agencies. Choose your favorites and learn all there is to learn.

Remember that scanning can be a very serious hobby. You will become educated through listening. Today, ten years after I first purchased a scanner, I have come to appreciate the people that go about their work daily on my city streets. Police officers, fire fighters, paramedics, city workers, truck drivers, dog catchers, delivery services. I have looked behind the scenes of so many different professions, from law enforcement to railroad transportation to flying. All that I have heard has pushed me to seek more knowledge, to learn more about what I am hearing.

Your scanner is a great tool, not only for entertainment, but for education. Use this tool as you would any other: keep it clean and maintain it, learn how to use it correctly, practice with it and use it wisely, safely and legally. Remember that the information you receive from your scanner is information that the "general public" does not know, in most cases. Gather this information with care and discretion, don't relay it to third parties and always be cognizant of your role...that of a listener, a monitor. Your scanner is a license to listen, that's all.

My fondest hope is that this book will become a key for you to open a door on the world of scanning and begin to hear some of the many signals available for those who seek them out. You will be intrigued, delighted, horrified, and disgusted at times with what you'll hear, but you will be informed. Information is what the voices from the scanner are all about.

Good luck and keep scanning!

Frequency Band Allocation Table

25 - 1300 MHz

♦

25.000 - 25.330	Petroleum
25.330 - 25.600	US Government
25.600 - 26.480	Broadcasting
26.480 - 26.960	US Government
26.965 - 27.405	Citizens Band Radio
27.430 - 27.530	Business Radio Service
27.540 - 28.000	US Government
28.000 - 29.700	10-meter Amateur Radio Service
29.700 - 29.890	Forestry Radio Service
29.890 - 30.000	US Government
30.000 - 30.560	US Government
30.560 - 30.640	Special Industrial
30.640 - 30.820	Petroleum/Motor Carrier/Forestry
30.820 - 31.260	Business/Motor Carrier/Forestry
31.260 - 31.980	Forestry/Special Industrial
32.000 - 33.000	US Government
33.020 - 33.160	Highway Maintenance/Sp.Emergency/Business
33.160 - 33.400	Petroleum Radio Service/Business
33.400 - 33.980	Fire Radio Service
34.000 - 35.000	US Government
35.020 - 35.180	Business Radio Service
35.180 - 35.520	Paging/Special Industrial Services
35.540 - 35.680	Paging Services
35.680 - 35.720	Business Radio Service
35.720 - 35.860	Special Industrial Radio Service
35.860 - 35.980	Business Radio Service
36.000 - 37.000	US Government
37.000 - 37.420	Law Enforcement/Local Government
37.420 - 37.860	Forestry/Power & Water Utilities Radio
37.860 - 37.980	Forestry/Highway Maintenance/Sp. Emergency
38.000 - 39.000	US Government
39.000 - 39.980	Law Enforcement/Local Government
40.000 - 42.000	US Government

42.000 - 42.940	State Law Enforcment
42.940 - 43.000	Business Radio Service
43.000 - 43.180	Special Industrial Service
43.180 - 43.680	Special Industrial/Paging
43.680 - 44.600	Motor Carrier Radio Service
44.600 - 45.040	Law Enforcement/Forestry
45.040 - 45.640	Law Enforcement/Local Government
45.640 - 45.860	Law Enforcement/Highway Maintenance
45.860 - 46.040	Law Enforcement/Special Emergency
46.040 - 46.500	Fire Radio Service
46.500 - 46.580	Local Government Radio Service
46.610 - 47.000	FCC Part 15 Devices (Cordless Phones, etc.)
47.000 - 47.400	Highway Maintenance
47.400 - 47.680	Special Emergency/Special Industrial
47.700 - 48.540	Power & Water Utilities Radio Service
48.540 - 49.500	Forestry/Petroleum Radio Service
49.510 - 49.580	Forestry/Special Industrial Radio Service
49.600 - 50.000	FCC Part 15 Devices (Cordless Phones, etc.)
50.000 - 54.000	6-meter Amateur Radio Service
54.000 - 72.000	TV Broadcasting (Channels 2,3,4.)
72.000 - 73.000	Land Mobile, fixed control and relay
73.000 - 76.000	Land Mobile, fixed control and relay
76.000 - 108.000	TV/FM Broadcasting
108.000 - 118.000	Aeronautical Navigation Beacons
118.000 - 137.000	Aeronautical
137.000 - 138.000	Space Satellites
138.000 - 144.000	US Government
144.000 - 148.000	2-meter Amateur Radio Service
148.000 - 150.000	US Government (military)
150.000 - 150.050	Radionavigation/Satellites
150.050 - 150.800	US Government
150.800 - 150.965	Automobile Emergency Radio Service
150.970 - 151.130	Petroleum/Highway Maintenance Radio Service
151.130 - 151.490	Forestry Radio Service
151.490 - 151.595	Special Industrial Radio Service
151.600 - 151.955	Business Radio Service
151.955 - 152.0075	Telephone Maintenance/Sp.Emergency Paging
152.030 - 152.240	Mobile Telephone/Paging
152.270 - 152.480	Taxi/Business Radio Service
152.480 - 152.840	Mobile Telephone/Paging
152.840 - 153.035	Sp.Industrial/Rem.Broadcast/Motion Picture
152.035 - 153.395	Remote Broadcast/Forestry/Petroleum
153.400 - 153.725	Power & Water Utilities Radio Service
153.740 - 154.445	Fire/Local Government
154.450 - 154.490	Local Government/Power/Special Industrial
154.500 - 154.625	Business/Forestry Radio Service
154.625 - 154.950	Law Enforcement Radio Service

154.965 - 156.030	Law Enforcement/Lcl Government/Sp. Emergency
156.030 - 156.240	Law Enforcement/Highway Maintenance
156.240 - 157.425	Maritime Band
157.450 - 157.515	Automobile Emergency Radio Service
157.515 - 157.710	Taxi (mobiles)/Business Radio Service
157.710 - 158.070	Paging/Mobile Telephones (mobiles)
158.070 - 158.460	Power/Petroleum/Forestry Radio Services
158.460 - 158.670	Mobile Telephones (mobiles)
158.670 - 158.970	Paging/Local Government/Law Enforcement
158.975 - 159.210	Highway Maintenance/Law Enforcement
159.225 - 159.480	Forestry/Petroleum Radio Services
159.485 - 160.200	Motor Carrier Radio Service
160.205 - 161.565	Railroad Radio Service
161.600 - 161.760	TV/Radio Broadcasting
161.800 - 162.000	Maritime Telephone
162.000 - 174.000	US Government/Relay Press/Forestry
174.000 - 216.000	TV Broadcasting (Channels 7 - 13)
220.000 - 222.000	New Mobile Radio Service
222.000 - 225.000	Amateur Radio Service
225.000 - 400.000	US Government (military aero)
400.000 - 406.100	Space Satellites
406.100 - 420.000	US Government
420.000 - 450.000	Amateur Radio Service
450.000 - 451.000	Remote Broadcast News Media
451.000 - 451.150	Power and Water Utilities Radio Service
451.150 - 451.750	Power/Petroleum/Forestry
451.750 - 452.025	Special Industrial Radio Service
452.050 - 452.300	Taxi/Forestry
452.300 - 452.500	Taxi/Forestry/Motor Carrier/Railroad
452.500 - 452.600	Automobile Emergency Radio Service
452.625 - 452.950	Motor Carrier/Railroad
452.950 - 453.000	Relay Press Radio Service
453.025 - 454.000	Law Enforcement/Local Government/Fire
454.025 - 454.350	Radio Common Carrier
454.375 - 455.000	Mobile Telephone
455.000 - 456.000	Remote Broadcast News Media
456.000 - 460.000	Mobile Units (5 MHz above repeater out)
460.025 - 460.625	Fire Radio Service
460.625 - 462.175	Special Emergency Radio Service
462.200 - 462.450	Manufacturers Radio Service
462.450 - 462.525	Mfg./Pwer/Forestry
462.525 - 462.750	General Mobile Radio Service
462.750 - 462.925	Business Radio Service
462.950 - 463.175	Special Emergency Radio Service
463.200 - 465.000	Business Radio Service
465.000 - 470.000	Mobile Units (5 Mhz above repeater out)
470.000 - 805.750	TV Broadcast (Channels 14-69)/Land Mobile

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